PERSONAL HYGIENE

AND

PHYSICAL TRAINING FOR WOMEN

BY

ANNA M. GALBRAITH, M.D.

Author of "Hygiene and Physical Culture for Women" and "The Four Epochs of Woman's Life;" Member of the New York County and State and the American Medical Associations; Fellow of the New York Academy of Medicine; Ex-President of the Alumnæ Association, Woman's Medical College of Pennsylvania; former Attending Physician, Neurological Department, of the New York Orthopœdic Hospital and Dispensary; late Attending Physician and Instructor in Diagnosis and Clinical Medicine at the Woman's Medical College, New York Infirmary

SECOND EDITION, THOROUGHLY REVISED

PHILADELPHIA AND LONDON

W. B. SAUNDERS COMPANY

1916

PRINTED IN AMERICA

PRESS OF
W. B. SAUNDERS COMPANY
PHILADELPHIA

In Loving Memory

of

HELEN WORTHING WEBSTER, M. D.

Professor of Physiology and Hygiene and Resident Physician at Vassar College from 1874 to 1881

An untiring worker of charming and inspiring personality
the living embodiment of all that was womanly,
great hearted, and noble
This book is affectionately dedicated as a slight tribute of
the esteem in which she was held, and in grateful acknowl-
edgment of the value of her teachings

By her former pupil

THE AUTHOR

PREFACE TO THE SECOND EDITION

SINCE the writing of this book six years ago the entire subject of digestion has been revised by scientific research, and thanks to the same scientists the nutritive value of the various food-stuffs has been ascertained. The importance of this knowledge is so great that educators are now making an endeavor to have the nutritive value of artificial and canned goods placed on their labels; and the New York Board of Health has requested a large Chain of Restaurants to have the nutritive value of foods printed, beside the cost of the various articles, on their bill of fare.

Hence the entire chapter on Digestion and Nutrition has been rewritten. In Chapter I has been given the result of original statistical studies, showing the urgent need for every woman to know and put into practice the principles of personal hygiene.

Dancing has become such a popular form of exercise that a description of the plates giving the dancing steps has been added, together with some simple dancing exercises. For these excellent descriptions the author is indebted to Miss Barbara Blankenhorn, a widely known teacher of music and dancing of Englewood, New Jersey.

The reason that such a comparatively short space was given in this work to "pelvic physiology and hygiene" was that this subject had been treated in extenso, in "The Four Epochs of Woman's Life."

ANNA M. GALBRAITH.

NEW YORK CITY,
November, 1916.

PREFACE

The aim of this work has been to present in a clear and concise manner the fundamental physiological laws on which all personal hygiene is based; together with the practical, detailed directions for the proper development of the body and the training of the physical powers to their highest degree of efficiency by means of fresh air, tonic baths, proper food and clothing, gymnastic and outdoor exercise, so that the tissues will be placed in the best possible condition to resist disease.

The spirit of the times demands nothing less than the most perfect development of body and mind of which youth is capable, and maintaining the highest degree of efficiency of the adult worker for the longest possible term of years. The *fiat* has gone forth from the American Medical Association for the scientific education of the public in the laws of hygiene and sanitation. And the great civic movement inaugurated by that same Association and the Committee of One Hundred on National Health for the establishment of a National Department of Public Health, promises to be crowned with success in the near future. And so it has been deemed superfluous to expound at length what preventive medicine has already accomplished in the short space of fifty years by the eradication of terrible epidemics and many diseases,

and what a general knowledge of applied hygiene might reasonably be expected to accomplish in the near future.

It gives the author great pleasure to have this opportunity of expressing her deep indebtedness to Miss Ruth Blankenhorn, Vassar College, A. B., 1909, of Englewood, N. J., a most artistic and graceful dancer who posed for all the illustrations; and to Miss Harriet I. Ballintine, the able director of the Vassar College Gymnasium, who arranged the poses for the very excellent plates illustrating the free exercises and classic dances. Also to the Vassar College Athletic Association for 1908–09 for the especially arranged dances and field sports which they were so extremely kind as to demonstrate for her benefit.

ANNA M. GALBRAITH.

NEW YORK CITY.

CONTENTS

CHAPTER IV

CHAPTER V

CHAPTER VI

CHAPTER VII

CHAPTER VIII

CHAPTER IX

PERSONAL HYGIENE

AND

PHYSICAL TRAINING FOR WOMEN

CHAPTER I

THE WISDOM OF PHYSICAL EFFICIENCY

Physical Efficiency as an Exact Science; Marks for Physical Efficiency; Statistical Study of the Physical Examinations of 160 Young Women; the Physical Status of the Women of Today; the Reflex Action of the Various Impairments of the Entire Organism.

"Circumstances," said Napoleon, "I make circumstances."

PHYSICAL efficiency stands for initiative, endurance, success; it is the very keynote of modern life and has become one of the burning questions of the day. West Point and Annapolis have always recognized this, and in order that their graduates should measure up to the highest standard of efficiency a most rigid physical examination was and is demanded as a prerequisite for admission; and during the whole of the four years' course physical training is systematically carried on so as to insure the most perfect physique possible, with the result that in addition to their great powers of endurance and initiative, is their distinguished carriage and elegance of bearing.

To increase the safety of their passengers the railroad companies were the next to demand these same physical examinations to determine the efficiency of their applicants and employees. Other large corporations followed.

So long as *women* remained in the home, or were willing

and content to accept any small wage that was doled out to them, the public did not seem especially interested in their physical condition. But when women, as a large teaching body or in any other public service, began to demand equal pay for equal work, the situation was materially altered, and in 1914 the English Royal Commission summed up the following conclusions: "Where the character and conditions of work performed by women approach those of the work of men, the pay of the women should approximate that of the men, but in so far as the *efficiency* of men is higher, the salaries of men should remain higher." This at once changed the complexion of the matter, and physical efficiency for women became a matter of paramount and equal importance to both employer and employee.

Again, from the standpoint of social science, the physical efficiency of women is demanded because they are the mothers of the race, and on them, equally with the fathers, does the welfare of future generations depend, since it is believed that a child inherits equally from its parents—one-fourth from father and mother each, one-fourth from its grandparents, etc. The states are beginning to seriously take up the framing of laws for eugenic marriages, based on fixed standards of physical efficiency of the contracting parties. And the day is not far distant when women as well as men will have to undergo physical examinations to secure or hold any positions of importance.

Then, too, one of the results of the present terrible European war has been to demonstrate that women possess a large amount of latent powers and endurance which only needed for their development the same general physical training that the state gives her sons. Women are now being employed in these countries in all branches of the civil service, as well as in agriculture and the making of munitions, engaging in a vast number of employments and trades hitherto considered unfit for women, because of the great physical strength and endurance which they demanded.

Physical Efficiency as an Exact Science.—Physical efficiency is growing to be an exact science; it is demonstrable in figures. We have standardized percentage tables for measuring the capacity of the lungs, the strength of the heart and muscles, and, added to these, must be a normal condition of the digestion, kidneys, generative organs, sight, and hearing. If the sum total of these amounted to 100 per cent., that would mean capacity for the greatest possible endurance under strain, and so the most effective worker; for there is a direct relation between the percentage standard of physical efficiency and the output of work, both as to quantity and quality.

Marks for Physical Efficiency.—Sir Francis Galton, the great English scientist, was the first to conceive the idea of assigning marks for physical qualifications. They were as follows: Breathing capacity, strength tests, both to be regarded with reference to the height and weight; quickness of response to a signal, made either to the eye or ear; the sense of sight and hearing, and the color sense.

Realizing the usefulness of these tests in measuring the physical efficiency, Professor Sargent included them in the physical examinations of the Harvard students. The strength tests consist of that for each forearm, of the back and legs, the dip, the pull-up, and the lung capacity. The combination of these seven tests is what is known as the intercollegiate strength test, and is the best means as yet devised for measuring the general muscular strength and the respiratory power.

It is obvious that many of these tests would be needed only by men going into the army or navy, or qualifying for civil engineers or professional athletes, etc. So it was considered best to modify these tests to meet the requirements of physical efficiency for women.

For the large number of measurements of the arms, legs, etc., included in the Sargent system have been substituted the rating of the condition of the heart and circulatory system, including the blood-pressure; lung and chest development; digestive and nervous system; the kidneys and gen-

erative organs; the muscular system; tests of endurance; ocular and aural tests; with a final impression of the working efficiency.

This standardized percentage table for physical efficiency of women was worked out and the ratings made with the able assistance of Dr. David Bovaird, Associate Professor of Clinical Medicine, Columbia University, and Dr. George A. Meylan, Associate Professor of Physical Education, Columbia University; and it has seemed to us that this combination of tests is of greater practical value, since the maintenance of physical efficiency depends upon the integrity of all of the organs of the body. These ratings were made to cover the Special Medical Blank for Women,[1] gotten up for the examination of the women candidates of the Presbyterian Board of Foreign Missions.

For many years the various Boards of Foreign Missions, which are the great church corporations, have required that candidates for this work should pass a physical examination similar to that demanded by the life insurance companies, and so similar blanks were sent out to be filled by the local examining physicians; but because of the many breakdowns of the women on the field, and the great detriment to the work and the expense thus entailed, four years ago the Presbyterian Board of Foreign Missions decided to have all of their women candidates re-examined in New York by a woman physician especially appointed by them for this purpose.

The results of these examinations have been most illuminating as to the physical condition of women who call themselves well, to say nothing of what the medical profession in general seem to consider as standards of good health in women who will be obliged to do very hard work under most trying climatic conditions, which all Life Insurance Companies rate as extrahazardous.

The composite picture thus obtained by the statistical study of the physical examinations of these 160 young women is of great value, not only because it is the first of

[1] See page 330.

the kind made for the first decade after leaving college; but also because it is very fairly representative of the average physical condition of the great masses of women who are engaged in teaching, social service, secretarial work, etc.; and, further, it demonstrates the striking difference in physique of women who call themselves well, and that of the normal standard of physical efficiency to which most of these women could have attained by proper physical education.

Statistical Study of the Physical Examinations of 160 Candidates.—This study is made from the records of four successive classes of young women coming from all over the United States, city and country, including college and non-college graduates, whose occupations were physicians, teachers, students, nurses, social workers, housewives, etc. All had passed a preliminary physical examination. The average age was twenty-eight years, when woman should be physically at her best.

I. Acute Diseases Since Childhood and Number of Days Lost Through Illness. For Classes of 1913 and 1914 Only, Consisting of 100 Women.[1]

History negative—*i. e.*, no history was given of any acute illness after the children's diseases	30 per cent.
Acute illnesses, including operations	70 " "
Previous year's record:	
Lost no days from illness	42 " "
Operations performed, followed by complete cure	27 " "
Marked loss of weight	23 " "
Total loss of time from illness, including postoperative treatment, would equal entire time of one woman for	8½ months.

Of the acute illnesses, the following are of the greatest interest because now preventable: Typhoid fever, 12 per cent.; malaria, 6 per cent.; tonsillitis, 6 per cent.

Of the causes for operations, appendicitis leads with 13 per cent.; of these, 9 per cent. were simply for the removal of the appendix; 2 per cent. for the removal of the ap-

[1] Similar records for the classes of 1915 and 1916 were not preserved.

pendix and diseased right ovary; and 2 per cent. for the removal of the appendix and ovarian cyst. The recovery was not only complete from the operation, but the general health was greatly improved in every respect.

Of the cases of tonsillitis, 4 per cent. were operated on not only with complete recovery, but also with the cure of rheumatism from which these women had previously suffered.

II. Heart and Circulatory System.

Examination of heart negative, with absence of murmurs	97.5 per cent.
Action of heart weak	54.0 " "
Pulse weak and rapid	50.0 " "
Subnormal blood-pressure	63.0 " "
Anemia present	55.0 " "
Normal condition of veins	95.0 " "
Subnormal temperature	40.0 " "
Class average	7.5 " "

III. Lungs and Chest Development.

Examination of lungs negative, with normal frequency and character of respiration	97.0 per cent.
Subnormal chest girth in relation to height and weight, of $5\frac{1}{4}$ inches	87.0 " "
Subnormal chest expansion of 1 inch	82.0 " "
Subnormal lung capacity, measured by spirometer, 45 cubic inches	75.0 " "
Unhealthy condition of nose and throat (postnasal catarrh or enlarged tonsils)	20.0 " "
Class average	7.5 " "

IV. The Digestive System.

Gastro-intestinal indigestion was present in	35.0 per cent.
Hepatic congestion with tendency to bilious attacks	20.0 " "
Constipation	33.0 " "
Catarrhal appendicitis (operation at once advised)	4.0 " "
Class average	8.5 " "

V. The Kidneys.

Urinalysis negative in	96.0 per cent.
Slight traces of albumin (with hyaline casts in 2 per cent.)	4.0 " "
Floating kidney	0.8 " "
Class average	9.6 " "

VI. The Generative Organs and Menstrual Function.

Pelvic organs normal	33.0 per cent.
History, menstrual periods normal	38.5 " "
Displacements and inflammation, uterus	67.0 " "
Accompanied by falling and inflammation of ovaries in	12.0 " "
Hemorrhoids	3.0 " "
Fibroid tumors	1.5 " "
Dermoid cyst	.75 " "
Operations advised for retroflexed uterus and curetage	1.5 " "
Dilatation and curetage	1.5 " "
Class average	7.5 " "

VII. The Nervous System.

Subject to headache	33.0 per cent.
Tendency to nervous exhaustion	11.0 " "
Hysteric	3.0 " "
Insomnia	7.0 " "
Mental poise good	75.0 " "
Class average	8.5 " "

VIII. The Muscular System.

The average height	5 ft. 3½ in.
Normal weight	126 pounds.
Normal relation of weight to height and age	33.0 per cent.
Averaged 17 pounds underweight	47.0 " "
Posture good in sitting and standing	33.0 " "
Posture bad, round shoulders, stooped position, muscles flabby	67.0 " "
Strength tests taken only for class of 1915 (30 women):	
Highest	802 points.
Lowest	338 "
Class average	570 "
Class average estimated	7.2 per cent.

IX. Tests of Endurance.

Took systematic daily exercise, walking 3 miles	25 per cent.
Took some exercise daily, 1 mile or under	50 " "
Took absolutely no systematic daily exercise	25 " "
Outdoor sports known, but not practised	10 " "

Test walk of 3 miles not given.
Heart reaction after exercise, hopping 100 feet, not given.[1]

X. General Impression of Working Efficiency.

Class average . . . . 8.2 per cent.

[1] As the physical examinations are made during the time of the Annual Conference, in order to shorten the time as much as possible the Board requested that the tests of endurance be omitted.

General Summary.

20	per	cent.	averaged	from	67 to 75	per	cent.
25	"	"	"	"	75 to 80	"	"
50	"	"	"	"	80 to 85	"	"
5	"	"	"	"	90 to 95	"	"

Class average estimated, 80 per cent.

Ocular Tests

Where the vision was normal, or had been corrected by glasses, this was rated as normal; because of the occupations of these women it was practically so.

The most striking points of weakness in the entire class were the bad postures in sitting and standing, consisting of round shoulders, a stooped position, and flabby muscles, 67 per cent.; a deficiency of one-seventh of the normal chest and lung development, accompanied by a deficiency of one-third of the normal chest expansion, 85 per cent.; weak hearts with weak and rapid pulse, subnormal blood-pressure, and anemia in over 50 per cent.; over 66 per cent. had some form of pelvic trouble which was acting to undermine the whole system.

Aside from tuberculosis, life insurance companies reject applicants who fall more than 20 per cent. below the normal standard of weight, and because of this 16 per cent. would have been rejected. The cause of this great loss of weight was due to malnutrition and overwork, and had it seemed practicable to adhere to Professor Meylan's wise advice that anyone who fell below 7.5 per cent. in any one series of tests, or below 75 per cent. in the general average, 20 per cent. of the entire class would have been turned down.

It must be taken into consideration that these examinations were made during the first week of June, at the end of a hard year's work; but, making due allowance for this, the results of these examinations have revealed such a subnormal condition of the vital organs of the body as to be appalling even to those of us who have long been familiar with these subjects. In addition to this was the fact that many unsuspected ailments needing immediate attention

by physicians or surgeons were discovered in a class of women who considered themselves well.

The Physical Status of the Women of Today.—The strong presumption that the above statistics are very fairly representative for the average woman of today is strongly borne out by data furnished by the absence on account of illness of the teachers of New York, and by corresponding statistics recently published by the Life Extension Institute of New York City.

Statistics compiled during the year 1913–14 showed that more than 20 per cent. of the teachers of the New York public schools were absent at some time on account of illness, and that these absentees averaged 16½ school days. The data obtainable showed four prevalent ailments: diseases of the respiratory organs, 35 per cent.; acute contagious diseases, 16 per cent.; nervous diseases, 15 per cent.; and digestive disorders, 11 per cent. And on the health of the teachers ultimately depends the efficiency of the entire educational system of the country.

The Life Extension Institute of New York, in its tabulation of 2000 examinations of young men and women clerks between the ages of thirty and thirty-five years, showed *only* 3 per cent. normal, *i. e.*, free from bodily impairments and from habits of life which were leading to such impairments; and showed 59 per cent. sufficiently impaired to justify their recommendation to the definite care of their family physician. "These statistics were compiled at an age when the human being is supposed to be at the very prime of life. The results prove that the majority of young men and young women in New York City begin to die as soon as they are grown up. Deaths due to degenerative diseases have increased 86 per cent. in the past thirty years; this means an increased death-rate whereby between 100,000 and 200,000 lives are lost every year."

The Reflex Action of Some of These Various Impairments on the Entire Organism.—In the normal erect position of the body the trunk is given its greatest length, the head is held erect, the shoulders thrown back flat against

the ribs, the chest is high, and the abdomen flat. (See Plate III, Senegalese woman.)

In the bad postures noted in 67 per cent. of the entire class, of round shoulders with a stooped position and flabby muscles, we note four distinct and prominent factors in the breaking down of the human organism:

I. The Effect on the Chest and Lung Development and on the Action of the Heart.—In this malposition the upper part of the body is inclined forward, with the result that the chest is flattened to the extent of 1 inch. The restriction which this must mean to the expansion of the lungs is evident; and when it is realized that in the erect position the heart occupies the space between the breast bone and the spine, with practically no space to spare, the resulting interference with the heart's action is evident.

It is a very serious matter when we have superadded to a deficient chest development a deficient chest expansion. For these are the very women in whom because of their general run-down condition and undeveloped muscles the breathing is very superficial; the apices of the lungs, the favorite site of tuberculosis, and the deeper portions are seldom expanded; and not only does the body suffer from a deficient oxygen supply, but there is an equally defective suction power on the part of the heart, which means a poor circulation and a lowered general nutrition of the whole body.

The main function in metabolism is oxidation, and scarcely a step in the series of chemical changes proceeding within the body is possible in the absence of an abundant supply of oxygen, constantly renewed. Living in close rooms lowers the vitality to an extent little dreamed of by most persons.

II. The Effect on the Abdominal Viscera.—In the normal erect position the abdominal muscles remain taut and afford proper support and pressure to the abdominal viscera and the great splanchnic circulation of large blood-vessels; whereas in the stooped position the muscles of the abdomen, not being properly used, become weakened and

sag forward, causing the downward displacement of all of the abdominal viscera, with consequent disturbance of their circulation and function. Many cases of indigestion, congestion of the liver, and constipation can be explained in this way.

III. The Effect on the Circulation of the Spinal Cord.—The circulation of the spinal cord is very largely dependent on the tone of the muscles of the spine; hence the weakness of these muscles interferes with its circulation. In the spinal cord are large nerve-centers which have to do with the control of the arms and legs as well as of the organs of the trunk, so that anything which lowers the tone of these centers depresses the vitality of the organs supplied by them; and this is believed to be the cause of many cases of so-called nervous indigestion.

IV. The Waste of Energy which Results from Faulty Posture.—Weak foot, in its final stage flat-foot, is more common in women than in men because it is not purely a local condition in the arch of the foot, but primarily due to a weakened condition of the leg muscles that support the arch. Weak feet are gradually converted into flat-feet by faulty standing and walking and lack of leg exercises.

Many cases of nervous prostration are to be traced not merely to overwork or worry, but to the waste of energy which results from the faulty posture of the body and with the interference of the circulation in the spinal cord, and the consequent weakness of the nerve power which results. In other words, it is not the load which breaks the bearer down, but the way in which the load is carried.

Good chest and lung development, a strong heart, well-developed and firm muscles are the tripod on which rests physical endurance and resistance to disease. And this was just where the entire class was found to be gravely subnormal.

Physical training consists primarily of heart training; in increasing the breathing capacity; in strengthening and developing the heart and other muscles of the body. As

the muscles become stronger the body is held more erect, and this favors, as we have seen, all of its functions.

And it is not generally understood how great is the effect of physical training on the brain and mental activities. With a strong and vigorous action of the heart there is a feeling of courage and general exaltation; whereas with a weak heart and feeble circulation fear and impaired mental activity predominate.

The charge is constantly laid at the door of women that they seldom rise above the mediocre, and have never been leaders in the world of art, literature, the drama, science, or the learned professions; that it is men who have invented devices for the home!

According to statistics, of the 25,000,000 wage earners in the United States, 8,000,000 are women, of whom 1,250,000 are over forty-five years of age and 637,000 under fifteen years of age. From an economic point of view, anything which will raise the working efficiency of one-third of our producing population, whose average wage is now the paltry sum of $6 per week, must be welcomed, because it not only prevents loss of time from work, but also the cost of illness. The study of the above statistics demonstrates the fact that the physical efficiency of women can easily be doubled; that should mean that the average wage should be raised to $12 per week, which would be a vast economic gain to the individual, the home, and to the state.

CHAPTER II

HYDROTHERAPY

Description of the Skin; Functions of the Skin; the Physiologic Effects of Water, Hot and Cold; the Chief Varieties of Baths; Ablutions; the Tub Bath; the Alcohol Rub; the Cold Dip; Alkaline and Saline Baths; the Rain Douche or Shower Bath; the Hot Foot-bath; the Sitz Bath; Salt Ablution; the Turkish Bath; the Electric-light Bath; Indications for the Use of Turkish Bath, and Contraindications; the Douche; Rationale of the Douche; Contraindications.

The Internal Use of Water; Its Action on the Heart and Blood, on the Digestion; Therapeutic Indications for the Use of Water; Contraindications for Drinking Cold Water.

Enemas; Vaginal Douche; Douching the Ear.

The term hydrotherapy will be used here in its broadest sense, and may be defined as the hygienic and systematic use of water, both externally and internally, for the preservation and restoration of health and the prevention of disease.

The hygienic and therapeutic value of the systematic use of water is just beginning to be appreciated by the medical profession. When this newly acquired knowledge is put to practical use by the great masses of the people, there will be a greatly diminished necessity for the use of drugs. Indeed, water has been pronounced by a high medical authority to be, and probably is, more nearly a panacea for all human ills than any other known agent.

The bath is generally considered merely as a cleansing procedure, whereas this is only one of its beneficial effects. There is, in addition, the stimulation of all the functions and organs of the body obtained through the temperature of the water, and the mechanical stimulation which is obtained by the mode of application.

Again, the skin is not a mere covering for the body, but

one of its most important organs, with well-defined functions; so that, in order to obtain a clear understanding of the subject, it is necessary first to consider briefly the functions of the skin; and, secondly, the physiologic action of water.

Description of the Skin.—The skin is a very sensitive and complex organ, and upon the condition of the skin and the vicissitudes to which it is exposed the health of the individual is dependent to a very great degree.

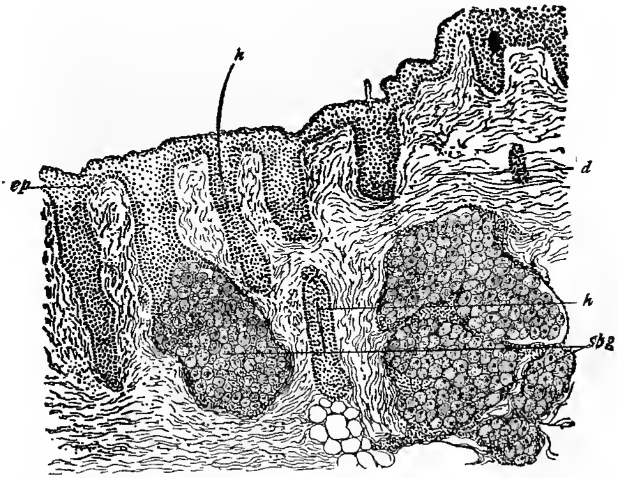


Fig. 1.—Vertical section of skin: *sbg*, Sebaceous glands; *ep*, epidermis; *h*, hair; *d*, derma (Fox).

The skin is composed of three distinct layers—the epidermis, the corium or true skin, and the subcutaneous connective tissue. The appendages of the skin are the hair, nails, the sebaceous and sweat-glands. This complicated structure is supplied with blood-vessels, lymphatics, and nerves.

The Epidermis.—The outer layer of this is the horny layer; when a blister is formed, its fluid raises the entire epidermis from the true skin. The flat scales forming the

horny layer are continually being thrown off; this process of desquamation is increased by the friction of the clothes, of bathing, massage, and so forth, and is as constantly being replaced by new cells from underneath.

The *corium*, or true skin, is the most important part of the integument. This is a thick, felt-like tissue which is pierced in all directions for the passage of the blood-vessels, lymphatics, sweat-ducts, and nerves, and affords lodgment for the hair follicles and sebaceous glands. The tension of the skin is produced by its muscular structure and elastic network, and is subject to temperature changes. This power of contractility is known as the tone of the skin.

The skin has two kinds of glands, the sebaceous and sweat-glands. The sebaceous glands consist of a gland structure, with a short excretory duct, which opens upon the epidermis or into the hair follicles. These glands secrete an oily substance, which keeps the hair and skin soft and protects them from the sweat.

There exists in the sebaceous glands of the skin an infinite number of vulnerable points for infection, and the greater part of the process of cleanliness is directed toward their protection. If in any part of the skin there is an accumulation of bacilli, their toxins, or excretions, and, at the same point, a collection of sebum, the friction of the clothes, caused by the movements of the body, becomes an active agent in effecting their absorption by the skin. Hence, the scientific basis for the necessity of the daily bath.

In the *subcutaneous tissue* we find the fat; it is this part of the skin that contributes to the roundness and beauty of the body. It is increased by abundant fatty food, sedentary habits, and freedom from care.

Functions of the Skin.—The skin exercises three distinct functions: first, as an organ of sense; second, as an organ of excretion; and third, as an organ of heat regulation.

Next to sight, the sense of touch is the most important of all the senses. Through this sense the human organism is made conscious of its contact with the outer world. The cutaneous nerve-endings stand guard, as it were, over most of the functions of the human body.

The importance of the action of the skin as an organ of excretion will be better understood from the well-known fact that the skin is one of the most important aids to the kidneys. That the perspiration and the urine are to a certain extent vicarious excretions has been proved.

The blood is the circulating medium which not only serves to convey nutritive materials from the stomach to the tissues, and the excrementitious materials from the tissues to the excretory glands, but also to equalize the body temperature. It conveys the surplus heat from the interior of the body to the surface, where it may be dissipated by conduction, radiation, and evaporation. Nearly nine-tenths of the daily heat-loss takes place through the skin; and of this, one-seventh is due to evaporation, which is enormously increased by perspiration.

The amount of perspiration produced daily is about two pints, or in the neighborhood of $\frac{1}{64}$ of the body weight. This is double the amount of water thrown off by the lungs. The watery portions of the perspiration are readily evaporated, and the solid constituents are deposited upon the skin. Urea and uric acid, together with more subtle poisons, are found in the sweat.

Animal Heat.—The heat of the body is wholly derived from foods, which, when completely oxidized within the body, produce practically the same amount of heat and energy that would be generated by their combustion outside the body.

But it is essential, in order to keep the body of warm-blooded animals at a constant or normal temperature, that an increase in the heat-production should be accompanied by a corresponding increase in the heat dissipation; the functions are reciprocal, and this equilibrium

is regulated and maintained by a special nervous and functional mechanism.

The automatic protective measures against the effects of heat are:

First.—Dilatation of the cutaneous vessels and an acceleration of the circulation through the skin and the subcutaneous tissue. By this means the dissipation of heat is increased; the sweat at the temperature of the blood, deposited upon the surface of the body, evaporates under favorable circumstances, and in this way considerable amounts of heat are abstracted from the body. In consequence of sweating and its evaporation, the blood circulating through the skin is cooled, and returning to the internal organs at a lowered temperature, prevents their overheating.

Second.—Should the action of heat be continued for a greater length of time, a large amount of blood will be retained in the skin in consequence of the loss of tonicity of the cutaneous vessels; the cutaneous circulation will be slowed, and thereby the blood, heated at the surface of the body, is prevented from returning to the internal organs and so overheating them.

Third.—In consequence of the accumulated amount of blood in the skin, a diminished amount of blood will remain in the internal organs; thus their activity, and thereby also the production of heat, will be lessened.

In these processes will be found a safeguard against the excessively rapid penetration of heat to the internal organs, and against the unduly rapid elevation of the body temperature through thermic influences.

As a result of the stimulating influence of cold, there first occurs contraction of the skin and its vessels. This, by restricting the dissipation of heat, brings about perfect compensation if the abstraction of heat be but slight; and but partial compensation, if the abstraction of heat is more marked. In the latter event the body temperature will continue to decline, to a greater or less degree; in the former it will remain constant.

The role played by the skin in maintenance of the normal temperature of the body is indispensable.

The normal temperature of the adult human body is 98.6° F. in the mouth, and that of the rectum and vagina is one degree higher.

Fasting, sleep, and short applications of heat all decrease heat-production; during sleep the temperature of the body falls half a degree or more.

Respiration by the skin varies from ½ to 1 per cent. of the total amount of oxygen taken into the body, and a somewhat lower percentage of carbonic acid is thrown off through this channel.

The skin absorbs substances in watery solutions with difficulty, on account of the oil lying upon and in the epidermis; substances dissolved in oil and rubbed in are more rapidly absorbed; absorption takes place rapidly after the skin has been washed with ether, chloroform, or alcohol.

The Physiologic Effects of Water.—These depend on whether the water is taken internally or applied externally. If applied externally, the effects will depend upon the temperature, whether hot, tepid, or cold; also on the manner of application, but, most of all, on the length of time which it is applied and the state of health of the individual.

The temperature of water is classified as very cold, from 32° to 55° F.; as cold, from 55° to 65° F.; cool, from 65° to 80° F.; tepid, 80° to 92° F.; warm, 92° to 98° F.; hot, 98° to 104° F.; very hot, 104° F. and above.

Heat.—A general hot bath produces dilatation of the vessels of the skin and contraction of the vessels of the brain; a general activity of the glands of the skin, both perspiratory and sebaceous. Perspiration may be produced, either to the degree of slight moisture or of profuse sweating, according to the length of time and the intensity of the application made. In a very hot bath the rate of perspiration may be increased from fifty to sixty times the ordinary amount. The most pronounced effect possible may be secured by either the electric light or sun bath.

Loss of fluids from the body has a depressing effect similar to, though somewhat less marked than, that produced by bleeding, so that there is a vital necessity for administering water internally before, during, and after the bath.

Prolonged and repeated perspirations induced by artificial means weaken the skin, and thus lessen its power to resist cold impressions, unless counteracted by frequent cold applications.

The general and usual reactions following the applications of heat are atonic and depressing in character. For the most part, the reactions following cold applications are to be preferred to those following hot ones.

The three great vascular areas of the body are the muscles, the portal system, and the skin. Each of these parts may be regarded as a great reservoir, capable of retaining a large part of the entire amount of blood of the body. When one of these areas is in a state of congestion, the others must be in a comparative state of anemia.

The restorative effects due to the application of heat are due partly to the elimination of fatigue poisons which is thereby encouraged, as well as by the reflex stimulation of the nerve-centers. The good effects are much more decided and lasting, and the exhausting effects neutralized, if the hot application is followed by a short cold one.

The effects of a neutral bath, 92° to 95° F., is sedative, diminishing nervous irritability.

A hot-water bottle or fomentations, placed over the stomach for an hour or two after eating, increase the gastric secretions, and, when placed over the liver, increase the flow of bile.

The Physiologic Effects of Cold.—In suitable cases a short general application of cold is a powerful heart tonic. Cold causes a contraction of the vessels of the skin and of those of the brain, with a dilatation of the internal vessels. There are pallor and coldness of the skin, and an almost instantaneous suspension of perspiration,

which is dangerous only when the body is in a state of fatigue.

If the application of cold is long continued, the surface becomes blue, the temperature of the muscles beneath the skin is lowered, thus checking heat-production in these muscles; the circulation is slowed, and the heart's action is diminished in frequency. There is a gooseflesh appearance of the skin; a sensation of chilliness, trembling, shivering, chattering of the teeth; at first a quickening and then slowing of the pulse, and deep gasping respiration.

When the cold application is considerably prolonged, the tendency to reaction is suppressed. There is an exhaustion of the nerve-centers as well as of the heat-producing powers of the body. Thus, the system gradually loses its power to resist the depressing effects of cold. The repeated chillings of the body increase the length of time required to return to the normal temperature. Applications of water below the temperature of the body always lower the temperature.

Reaction.—If the application of cold is of very short duration, of very low temperature, and given under high pressure, the phenomena of reaction begin immediately on its cessation.

The reaction consists in a dilatation of the surface capillaries, with contraction of the internal vessels; redness of the skin; the skin is smooth, soft, and supple; there is a sensation of warmth, comfort, and well-being; respiration is slower and deeper; there are a fall of the internal temperature and increase of perspiration.

Certain measures to favor reaction should be taken before the bath, such as exposure to the air of a warm room, drinking hot water, and short exercise of a rather vigorous kind.

During the bath the measures which favor reaction are short, sudden applications of cold, friction while in the bath with the hand, and pressure effects in the douche.

After the bath reaction is favored by vigorous rubbing,

a thorough drying of the body, warm clothing, warm air of the room, and as vigorous exercise as the strength of the individual will permit.

Conditions which are unfavorable to healthy reaction are: old age, infancy, exhaustion, either temporary or from an excessive loss of sleep, or extreme nervous exhaustion, obesity, rheumatic diathesis, unhealthy or inactive skin, profuse perspiration when accompanied by a state of fatigue, extreme nervous irritability, a very low temperature of the skin, an immediately preceding or impending chill, and extreme aversion to cold applications.

The average temperature of the human nude skin is in the neighborhood of 90° F. The difference between the temperature of the skin and water is the chief element in determining the reaction of the individual. It is evident that water at a temperature of 90° F. would be neutral or indifferent; the difference of intensity of effect is in proportion to the difference of temperature of the water and skin. The duration of the cold procedure is an important element in the production of reaction. It may be laid down as a rule never to give any cold-water application without friction. The physical and psychic state of the individual exerts more or less influence upon his reactive capacity. An anemic, or otherwise depressed individual must be managed with great circumspection, because she bears heat abstraction badly. The hydriatic procedure must always be adapted to the reactive capacity of the bather.

The woman must be thoroughly rubbed after the bath until a good reaction has occurred. Especial attention must be paid to the feet and legs. The bather should first be rubbed with a warm towel or sheet, and then with the bare hands of the attendant, as the warm hand greatly facilitates the reaction. The bather is by no means dry when the skin ceases to feel wet. So long as the skin is soft and spongy, it still contains moisture which has been absorbed by the superficial layers of the epidermis. The absorbed moisture, being left to evaporate after the bath,

the individual is liable to become chilly and contract a cold, which is erroneously attributed to the bath itself.

Other injurious effects following imperfect reaction after the cold bath are secondary chills or a continuous chill lasting for several hours. The hands and feet are cold, there is headache, not infrequently diarrhea, and other evidences of internal congestion, such as abdominal or ovarian pain, vertigo, etc.

Reaction may be favored by covering the patient with blankets, surrounding her with hot-water bottles, and giving her hot tea to drink. Exercise should follow the bath. Walking for from twenty minutes to an hour is the most usual form of exercise. Very vigorous exercise for a short time cannot be substituted for moderate exercise for a longer time.

The Tonic Effect of Cold Upon the System.—The effect of cold upon the muscles, when given in the form of a cold bath, douche, or spray, is to augment muscular energy and tone to a very great extent; this increased muscular tonicity is the cause of the slight shivering. The cold douche, if short,—one or two seconds,—and given with a pressure of from 25 to 30 pounds, is a powerful restorative in fatigue resulting from severe muscular effort, but it must be immediately preceded by a short hot bath, and must be followed by vigorous rubbing and wrapping in a hot blanket.

Short cold applications cause elevation of temperature and increased metabolism, while prolonged cold applications cause a fall of temperature and decrease of metabolism.

The tonic effect of cold water is believed to be due to the stimulation of the sympathetic nerve-centers. The sympathetic nervous system controls the blood-vessels, heart, the functions of secretion and excretion; and, indeed, all the vital functions of the body.

The sensation of well-being which accompanies the reaction following a general cold application is largely due to an increased activity of the cerebral circulation.

Cold water is a physiologic tonic, and the cold bath, properly employed, increases the vital resistance to pathologic processes.

All applications of water at a temperature low enough to provoke vital resistance are tonic; hence, tonic effects are produced by all temperatures below 90° F., but the most certain and pronounced results are obtained from the douche in every form, which adds mechanical impact to the thermic effects of cold. The most durable tonic effects are produced by the frequent use of very cold and very short baths.

A tepid bath causes a lowering of the body temperature.

The Chief Varieties of Baths.—These, in the order of frequency with which they are used, are: ablutions; tub; foot-tub; sitz; salt sponge; shower; Turkish; horizontal jet; needle; fan douche; Scotch douche; Roman and electric-light baths.

Ablutions or Sponge Baths.—These baths are of universal use. The sponge is one of the dirtiest and most impossible articles of the toilet to clean and to keep clean. It is a collector of dirt and germs, and should be banished from every bath-room and from every house. It is not sufficient that each member of the family should have her own sponge; it is quite possible for the individual to become infected or reinfected from her own sponge. Incidentally, it does not afford sufficient friction, and thus does not favor reaction. In taking ablutions, the application of water may be made with the hand, though it is best made by means of a wash towel. The good effects of the simple ablution will be greatly enhanced by the use of the hat tub, and this especially where there is no bath-tub in the house.

When the bath is taken for the purpose of cleanliness, the water should be warm or hot, and pure Castile soap is one of the best that can be used. If the skin is rough, a good sand soap will be more beneficial. The bath should be completed by dashing cold water over the body with the wash-towel.

The body must be quickly and thoroughly dried by means of a rough bath-towel. After this, the skin may be still further toned up by a good alcohol rub.

If the ablution is taken simply for the tonic effect, it is generally taken on rising in the morning, and the water used is cold. The ablution may be confined to the upper part of the body, that is, the chest and back; and consists in friction with a rough wash-towel, followed by dashing the water over the body; followed by brisk friction with a rough bath-towel. This procedure causes a marked stimulation of the heart and lungs, and is followed by a rise of temperature.

In winter all baths must be taken in a warm room.

There is a decided increase of muscular and mental capacity after the cold ablution, demonstrating the tonic effect it has produced.

The cold ablution may also serve as an introductory to other and more heroic hydriatic procedures. If the reaction is not good, water at a higher temperature should be used, and only small portions of the body should be attacked each day, followed always by brisk friction. As the reaction becomes better, the temperature of the water should be gradually lowered from day to day.

There must be a decided sensation of warmth of the body before proceeding to take any form of cold bath. This may be induced by sipping a cupful of hot water before rising, and then being well covered with the bed-clothes until the body is in a glow. In conditions of anemia or neurasthenia, where the circulation is markedly poor, in addition to drinking the hot water, the bather may stand on hot blankets while taking the cold ablution, and after it be rubbed briskly with hot towels.

Nothing is gained, and a great deal of harm is done, by trying to persevere in the daily cold ablution when it is followed by a pallor of the skin, chilliness, etc.

The Tub Bath.—This is much more refreshing, more salutary, and may be used to produce a much greater variety of effects than the simple ablution. Tub baths

may be classified according to the amount of water in the tub as half or full tubs; and again, according to the temperature of the water, as warm, tepid, hot, and cold. The half tub contains about 30 gallons of water.

In a general way it may be said that the half tub of warm water is used for the purpose of cleanliness; the hot baths for breaking up colds, for rheumatism, etc.; the tepid bath to allay nervousness; and the full cold tub, for the tonic morning dip.

For cleansing purposes the so-called half tub, that is, the tub contains a sufficient amount of water to reach above the pelvis when one is seated in the tub, is used. The temperature ranges from 98° to 102° F. Five minutes is as long as the bather should remain in the tub, as all hot baths are more or less exhausting. After an initial immersion in the water, the scrub takes place by means of the Turkish bath-towel, or, better, by the use of the flesh brush. If there is a shower attached, the hot bath should always be followed by a brief cold shower; if not, the cold water should be turned on and dashed over the body by means of the wash-towel. This closes up the pores of the skin, prevents the profuse perspiration from taking place that so often follows a hot bath, and greatly diminishes the susceptibility to taking cold. An alcohol rub completes the procedure. This insures a further toning up of the cutaneous vessels. A small quantity of alcohol is poured into the hand and applied to a limited area of the body. It is well rubbed in with friction until the alcohol has wholly evaporated. Beginning with the arms, the legs, chest, and back are successively gone over.

The hot bath is best taken immediately before retiring, and should not be repeated oftener than twice a week. Retiring to bed at once, the bed acts as the cooling chamber of the Turkish bath. The hot bath is most restful, and, except in rare cases, tends to the production of refreshing sleep.

If the bather has a weak heart, suffers from shortness of breath, or is weak from any cause whatever, she should

only take a half tub bath, since it has been learned from experience that when the water covers the entire body, there is increased difficulty in the respiration, and the heart's action often becomes embarrassed, palpitation of the heart is experienced, with a feeling of impending suffocation. There is sometimes also a feeling of faintness. On getting into the tub, the temperature of the room should never be above 68° to 70° F.

The Full Tub or Immersion Bath.—In this form of bath there is a complete submersion of the body in the water, so that the water reaches the under surface of the chin, the head of the bather resting on a cross strap, being the only portion of the body uncovered by the water.

If the bath is tepid, that is, has a temperature of from 80° to 90° F., great care should be taken to have the chest covered, in order to prevent pulmonary congestion. This is best accomplished by placing a Turkish towel, wrung out of hot water, about the chest and shoulders of the bather just after she enters the tub.

If the bath is hot, from 98° to 104° F., before entering the bath the face and neck are rubbed with cold water, in order to relax the vessels of the brain and so prevent cerebral anemia. Except when the hot bath is given for especial therapeutic purposes, as for rheumatism, cystitis, colic, etc., it should always be followed by a cold application.

The Cold Dip.—For the dip, the tub is filled with water at a temperature of from 65° to 55° F. The duration of the dip varies from two or four seconds to one or two minutes. The bather should wet the face and chest before entering the water. It is best to enter the bath suddenly, as the sensation of cold is thus far less noticeable than when the bath is entered gradually. If the stay in the tub is more than momentary, vigorous rubbing must be kept up during the entire time spent in the tub.

For persons in good health a cold dip on rising in the morning is excellent. It creates an appetite, accelerates the circulation, arouses the nervous system, and produces

decided exhilarating effects in those who are strong enough to react after it. When employed for this purpose, the immersion should not be more than from three to fifteen seconds. The bather must rub herself vigorously while in the tub, and follow the bath with brisk toweling and plenty of friction. She should then take moderately active exercise for fifteen to twenty minutes.

For any one just beginning to take the cold dips, the temperature of the water should be just 1 degree below that of the body, and gradually lowered by a drop of 1 degree every morning or two. Or, the dip may be preceded by a preliminary warm bath or warm shower.

The salient point in connection with bathing is not to allow the skin to lose heat too rapidly. To apply this as a warning in the case of cold baths: it has been estimated that the heat loss from the body immersed in cold water at the temperature of 86° F. is double the normal; at 77° F., three times, and at 68° F., five times, the normal.

The daily use of the cold dip for those who are able to react after it is one of the best means of fortifying the system against both acute and chronic diseases.

Contraindications.—The use of the cold dip is contraindicated for young children, the aged, and in run-down conditions of the system; in all cases where the action of the heart is weak, in Bright's disease, or in any acute or chronic congestion of the kidneys; in all acute inflammations, as inflammation of the bowels, peritonitis, or inflammation of the uterus and ovaries.

Alkaline Baths.—For these baths from 4 to 12 ounces of the carbonate of soda should be used to 30 gallons of water. The water should have a temperature of from 92° to 96° F. This bath is useful in many forms of skin disease, and relieves the itching of jaundice and urticaria.

Saline Baths.—The typical saline bath is the salt-water bath. Sea-water contains in solution from $\frac{1}{3}$ to $\frac{1}{4}$ pound of solids to the gallon of water. The principal ingredients are common salt, magnesium chlorid, and magnesium sulphate. These substances have a decidedly

stimulating effect upon the skin and encourage reaction. For an artificial sea-water bath, 8 pounds of sea-salt should be used to 30 gallons of water.

Ordinary coarse salt is purer, contains from 97 to 98 per cent. of the chlorid of sodium, is cleaner, and makes a clearer solution, and it dissolves in about one-third of the time required for sea salt, and can be obtained for about one-third of the cost.

As a cleansing agent, a 5 per cent. brine is equal or superior to soap. Further, the axilla and hairy parts remain clean and sweet for a much longer time than after the use of soap. These brine baths, taken three times a week, are followed by a great improvement in the general health.

The Rain Douche or Shower Bath.—The shower is the most tonic of all the baths that can be taken at home, and no bath-room should be considered complete without it. In this form of douche the water is projected through a perforated disc, falling upon the bather in a number of fine streams. It is necessary for the bather to wear a rubber cap in order to keep the hair dry. In taking the shower bath the bather stands up; the disc is generally placed about 3 feet above the head. The water should be allowed to fall first upon the feet, then the hands, arms, shoulders, back, and, lastly, upon the chest and abdomen. The bather should keep in active motion during the application, flexing the limbs, and rubbing the chest with the hands. At the beginning of the shower the hands should be placed over the chest, in order to protect the precordial region from the impact of the water.

The cold shower should be preceded by some kind of a heating process—either a hot plunge or a hot shower bath. A shower of from 100° to 104° F. may be applied for one to three minutes before the cold application. A cool shower of 75° to 65° F. is an excellent training for persons who are sensitive to cold. The neutral shower, 92° to 97° F., given for three to five minutes, is sedative in its effects.

The cold shower, 60° to 70° F., duration from five to thirty seconds, is useful in phlegmatic neurasthenics and dyspeptics; sedentary people in whom the general metabolic activity is diminished; also in obesity and in all cases after a sweating process. By standing in hot water the bather is much more tolerant of cold.

The neutral shower is one of the most effective measures for the relief of insomnia; especial attention should be given to the back and legs. The action is quicker than that of the neutral immersion bath.

As a hygienic measure, the shower bath offers a most agreeable and rapid means of cleansing the whole surface of the body.

Since the effect of the douche depends on the pressure, it will be readily understood that the hose attached to the faucet of the domestic bath-tub is merely a sprinkler, and not a douche, in the proper sense of the word. Such a procedure can only be tolerated by the most robust. In the upper stories of most city houses the pressure is probably not more than from 3 to 10 pounds; the stream of water from the sprinkler is really only a drizzle; the mechanical effects being so slight, there is no reaction produced; the result is that its use is followed by a feeling of chilliness and depression.

The Hot Foot-bath.—The temperature of this bath should be at the beginning from 102° to 104° F., and the duration from three minutes to half an hour. The pail is nearly filled with water, care being taken that it shall not be so full as to overrun when the feet and legs of the bather are put in. A blanket, closely wrapped about the patient and the pail, should come up above the knees. As the water cools off, hot water should be added.

This form of bath is most commonly used to relieve congestion and inflammation. The dilatation produced in the blood-vessels of the feet and legs relieves congestion of the brain and the organs of the upper half of the body, as well as of the pelvic viscera. It should be taken immediately before retiring.

The Sitz Bath.—The sitz or hip bath requires a tub made for that particular purpose. The back of the tub, which is most commonly made of tin, is cut high, while the front must be sufficiently low for the patient to sit comfortably in it, without undue pressure being made on the under side of the knees.

The tub is half filled with water of the prescribed temperature. It is well to begin with water at a temperature of 102° F., and increase the temperature while the patient is in the tub, making it as hot as is comfortable.

In giving all hot baths a thermometer must be used, and a word of warning must be given about adding hot water

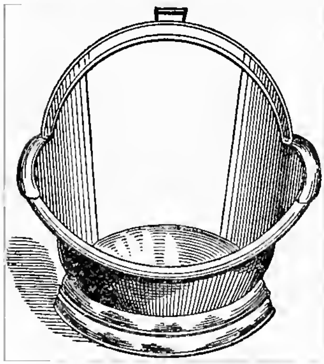


Fig. 2.—Sitz-bath tub made of tin (Ashton).

in case of sickness, as well-authenticated cases of paralysis are recorded in which the temperature sense of the patient was lost, and, in adding hot water, it was raised to such a temperature that the legs and feet of the patient were scalded.

During the sitz bath the patient keeps on her stockings and bedroom slippers, and, unless friction is ordered, the entire body, as well as the feet and legs, are enveloped in blankets.

The duration of this bath is from three to ten minutes.

This bath is especially useful in restoring the menstrual function when it has been suspended as the result of chill or other causes; also, for relieving hemorrhoids, uterine colic, neuralgia of the ovaries, and inflammation of the bladder.

To prolong the effect of the bath the patient may be put to bed wrapped up in her blankets. In cold weather it is a good precautionary measure to have the bed heated with hot-water bottles, in order to prevent chilling.

Salt Ablution.—As the name indicates, this is a salt-water bath, and the best results are obtained by using a saturated solution, which is in the proportion of 1 pint of salt to 1 gallon of water. Sea-salt is the best, but, if that cannot be obtained, ordinary salt may be used.

If there is no bath-tub in the house an ordinary wash-bowl may be used, but the bath is most effective when taken in the tub. The salt and water are put in a papier-mâché pail, which is placed at the foot of the tub. The chilliness which might be caused by sitting on the cold porcelain is avoided by placing a heavy folded bath-towel on the bottom of the tub. In cold weather the tub should be previously heated by allowing the hot water to run in.

The salt water feels very much colder than plain water at the same temperature. It is well to begin with a temperature of from 90° to 85° F., and gradually lower the temperature until 70° F. is reached.

The water is applied by means of a Turkish wash-towel, accompanied by vigorous friction, beginning with the face and neck, arms, legs, back, and, lastly, the chest and abdomen are gone over. After that, the water is dashed over the entire body, and is followed by a brisk toweling and friction with the hands or hair glove. The salt water should not be washed off, except in those rare cases where it causes a disagreeable sensation; it is then removed by the use of the hot followed by the cold shower, as previously directed.

Indications for Its Use.—It is an excellent nerve tonic

in cases of depression with loss of appetite, insomnia, etc., also in anemia and neurasthenia. In this class of cases it is best taken in the afternoon, on rising from the siesta, and just before dressing for dinner. It is especially refreshing in the hot weather.

Its use is contraindicated under the same conditions that other cold baths are, and must never be taken when the bather has a tendency to chilliness.

The various kinds of baths previously described can all be obtained in the home, but the Turkish bath, with its various accessories, can only be taken in a properly equipped bathing establishment.

The Turkish Bath.—This form of bath dates back to the time of the Romans. The essential features of a modern establishment are: dressing-rooms; a warm room, with a temperature of from 110° to 130° F.; a hot room, temperature of 150° to 170° F.; a steam room; a shampoo room; a douche apparatus; a plunge bath, and a cooling room. In many establishments there is only one hot, dry-air room. The air of the room may be heated by steam-coils.

The bather, having disrobed, is enveloped in a sheet, and enters the hot room, where she reclines on a steamer-chair. A towel wrung out of cold water is placed on the forehead and changed as often as it becomes hot. The bather should drink a glass of cold water immediately before or on entering the hot room, and several glasses should be taken at intervals during her stay in this room.

The skin is highly stimulated and profuse perspiration results. The profuse sweating promotes absorption from the alimentary canal, and so is a powerful stimulant to nutrition. It also emphasizes the necessity for copious water-drinking.

Great harm often results from a too prolonged stay in this room. Ordinarily, the bather should leave the room as soon as free perspiration is established; that is, in from fifteen minutes to half an hour.

From this room the bather next enters the Russian

bath or steam room. It is very much more agreeable to have very little steam in the room on entering; when the steam is very dense, a feeling of suffocation may occur. Any one with a weak heart should avoid the steam room altogether, as it is apt to cause a sense of great oppression. For the complexion, bronchitis, or laryngitis, it is excellent.

From the hot room the bather goes to the shampoo-room, where, lying upon a marble slab, she is first gone over from head to feet by the wet hands of the attendant. This manipulation removes the layer of cuticle which has been loosened by the free perspiration. These rubbings and strokings are continued until the skin feels smooth and polished.

The bather is next shampooed with soap and water, applied with a bath-brush. This may in turn be followed by a salt rub. After this comes a douche, given with a horizontal jet, at a temperature of 104° to 106° F., followed by a cold douche.

If the bather is a strong woman, she may now enter the cold plunge. The temperature of this should be from 70° to 60° F.; this must only be a quick dip. She is then vigorously rubbed and dried. After this she lies down in the cooling room and has an alcohol rub, which completes the procedure. She should rest here for half an hour at least before dressing. The pulse should be normal and the skin perfectly dry before she dresses and goes out on the street.

In winter, instead of the ordinary alcohol rub which is given, it is much better to have a thorough massage with cocoa-butter or almond oil—the so-called Roman bath. Just following the Turkish bath much of this oil will be absorbed, which is beneficial for thin people, and, in any case, it will lessen the danger of getting chilled on going out into the cold air.

The woman unaccustomed to these baths should under no circumstances go to a Turkish bath without consulting her physician, as great harm might result. The bath should not be taken oftener than twice a week, unless by

special orders of the physician. Care must be taken not to overuse them, as frequent and prolonged exposures to the sedative influence of heat is very debilitating. The wise woman will provide her own bathing cap, bath-brush, and straw sandals.

The use of the Turkish bath is indicated in rheumatism, toxemia, chronic dyspepsia, biliousness, obesity, sciatica, and lumbago.

The contraindications to its use are, in Bright's disease of the kidneys, in most pulmonary affections, in the advanced stages of arteriosclerosis, and in diabetes with emaciation.

The Electric-light Bath.—This is now frequently used instead of the hot-air room of the Turkish bath, and possesses many advantages. A cabinet is lined on three sides with mirrors, on which are arranged 50 or 60 electric-light bulbs; the mirrors multiply the number of lights by reflection. A stool is placed in the cabinet for the patient to sit on, while the head protrudes above the top, which is closed. By means of switches and a proper grouping of the lamps in wiring, the number of lights, and so the temperature, can be instantly and perfectly controlled. The heat is derived by radiation, so that it is not necessary to have the air confined. In this form of light bath the body is directly exposed to the effects of radiant light and heat.

The incandescent electric-light bath is superior to every other form of heating procedure in which the only object is the preparation for the cold bath. The time required is not more than from three to five minutes. When it is desired to produce profuse perspiration, the patient may remain in from eight to fifteen minutes. A longer stay than this is apt to produce an overstimulation of the nervous system and an excessive elevation of temperature.

The electric-light bath possesses the distinct advantages that, while the body is exposed to a high degree of heat, the air of the room in which the head is, and which one

is breathing, may be cool, and unique advantages in the exactness of the dosage as regards time and intensity. It can also be used in a much greater number of diseases than the hot-air room of the Turkish bath.

The finishing treatment on leaving the cabinet is identically the same as that for the ordinary Turkish bath.

Indications for Its Use.—While the electric-light bath is not a complete substitute for sweating produced by exercise, it comes nearer to that than any other heating procedure, and, when followed by some vigorous cold application, it possesses a hygienic value which cannot be overestimated.

It is especially valuable in cardiac disease and diabetes. It stimulates oxidation, and is thus valuable in obesity and the toxemia of chronic dyspepsia; also in malarial cachexia, syphilis, neuritis, neuralgia, sciatica, habit chorea, hysteria, rheumatism, and anemia.

It is superior to all other treatment in chronic rheumatism and all diseases dependent on uric-acid diathesis or diminished metabolism, by the combined action of the elevation of temperature and the vigorous cutaneous activity. The elevated temperature stimulates the oxidation of the proteid wastes and augments vital combustion, while the increased skin activity carries off all waste-products prepared for elimination.

As a prophylactic, this form of bath is especially valuable for all persons leading a sedentary life; it is the best substitute for exercise in the open air, and, where there are no contraindications to its use, should be taken once a week.

In cases of obesity, sweating may be used to reduce the weight; but, in order to obtain the best effects, it must be combined with exercise, and it must be borne in mind, that in obesity there is great danger of overheating the blood, in consequence of the obstacles to heat elimination presented by the thick layers of non-conducting fat. Therefore, these hot applications for the reduction of fat should never be too much prolonged, and the bath should always

be finished by vigorous applications of cold. These cold applications have also a tonic effect upon the nervous system, and increase the muscular disposition for exercise, and this is the most rational treatment for obesity.

Loss of Weight.—There are many cases in which metabolism has been so sluggish, allowing an accumulation of imperfectly oxidized matters in the body, that the first active stimulation of the nutritive processes is in disproportion to the increased destructive metabolism. Under these circumstances there is necessarily a decrease in weight. The rubbish must first be removed and old defective structures before new and highly organized tissues can be deposited. A slight loss of weight need, therefore, give rise to no apprehension, but if the loss is considerable, or continues for some time, especially if accompanied by loss of strength or appetite, it is a matter for investigation.

Palpitation of the heart and fulness of the head are an indication that the applications have been too hot or too long continued. Vertigo and fainting are apt to occur when hot applications have been continued too long, but they are quickly relieved by cold applications, especially by cold affusions to the chest and shoulders. Headache may result, either from excessively hot or cold procedures. Deficient reaction is generally the result of a too prolonged application of cold.

On entering the electric-light cabinet, a wet towel wrung out of ice-water is placed around the neck and another around the forehead; or an ice-bag may be placed on the top of the head.

The Douche.—A douche consists of a single or multiple columns of water directed against some portion of the body. The apparatus is complicated, and it is essential that an accurate pressure-gauge and thermometer should be introduced into the circuit of the douche. It can only be properly administered in a hydriatic establishment. In the employment of the douche three factors must be considered—the temperature, pressure, and the mass.

The range of temperature employed varies from 45° to 125° F. The pressure ordinarily employed varies from 10 to 60 pounds. The mass varies according to the effect desired, and may be regulated by means of the finger, placed in the water column near the nozzle.

The douche is applied by means of the rubber hose, which is connected at its proximal end with the water-supply, and at its distal end is attached a nozzle, the average diameter of which varies from 2 inches to $\frac{3}{8}$ inch. From these a fine or coarse jet or a fan douche may be produced. The latter is formed by placing the index-finger of the hand holding the nozzle upon the lower border of the outlet, producing an expansion of the otherwise solid jet into a fan-shaped stream.

The mechanical effects of the douche are derived from atmospheric pressure, and this is of more importance in the effects produced than the temperature.

The Scotch douche consists of alternate streams of hot and cold water. The general cold douche is the most powerful of all the tonics; the warm or neutral douche is sedative; the very hot douche is frequently followed by atonic reactions.

Ràtionale of the Douche.—The douche is a thermic massage. Since the douche is a sorbefacient of pathologic products, the French have availed themselves of its use to aid the body to throw off an excess of uric acid, fatigue toxins, etc.

It has been demonstrated that a rain douche of 50° F., under a pressure of two atmospheres, increases threefold the work that the muscles are capable of doing, while the Scotch douche, oscillating between 98° and 53° F., doubles the working capacity of the muscles. Even tepid douches increase the working capacity of the muscles, while a tub-bath of the same temperature is without decided effect. The pressure under which the douche is given adds a powerful element, which is absent in other hydriatic procedures. The percussion and vibration affect the

vasomotor system much more powerfully than any form of still bathing.

The power and action of the heart are greatly improved by the use of the douche, the capacity of the lungs is increased, and the digestion is improved.

Brief douches of from ten to fifteen seconds generally act better than those of longer duration. The general condition of the patient must always be carefully studied, and, like the Turkish bath, the douche should always be taken under the direction of a physician, as they are also capable of doing a great amount of harm as well as good. The best results from the douche are obtained when it is taken following the use of the electric-light bath.

The neutral douche is particularly applicable in cardiac affections and in cases of high arterial tension. The sensation afforded should not be either that of hot or cold, and the duration from one to two minutes. The douche for this purpose should be given with only a slight degree of pressure, and to avoid irritation it should be directed to either side of the spinal column. This is a sedative application.

Contraindications for the Use of the Douche.—In all acute inflammations and in eruptive disorders of the skin. The cold douche is contraindicated in inflammation of the uterus, ovaries, kidneys, stomach, liver, bowels, and bladder, in intestinal catarrh, chronic inflammation of the stomach, and general neuritis. It must also be avoided in rheumatism, arteriosclerosis, cardiac insufficiency, valvular diseases of the heart with deficient compensation, fatty degeneration of the heart, and in cases of extreme nervous irritability.

The Internal Use of Water.—The internal use of water is essential to life. Water constitutes about two-thirds of the body weight; it is found in every tissue and organ of the body; it acts to dilute the foods so that they can be absorbed from the digestive tract; its presence in the blood is essential, both to carry foods to the tissues and to convey the waste matter away from the tissues. Its use

in the form of a lavage is even more necessary, to keep clean and free from impurities the mucous membrane lining the 30 feet of the digestive canal and the tubules of the kidneys than is the external use of water to keep the skin in a healthy condition. Its use is also needed to keep the blood-pressure and the heart in a normal condition.

About 4½ pints of water are given off daily in the excreta and exhalations; but, since about one-half of the solid foods taken consist of water, 3 pints of water, taken daily as such, are sufficient to counterbalance the loss.

All water for drinking purposes should be filtered. The best method is to have a filter attached to the pipes of the house-supply, so as to insure filtered water running from all the spigots.

If the water is not filtered, it should be boiled for thirty minutes. The water should be run off in the morning, then poured into a well-kept tea-kettle and boiled. It is then allowed to stand and become partially cooled in covered vessels, when it is poured into large bottles—quarts are the most convenient size; these should be stoppered with corks of absorbent cotton. When cool, the bottles are placed in the refrigerator beside the ice. Water should be boiled every morning for the twenty-four hours. Boiling for this length of time secures the destruction of all the germs of disease, and it is doubly essential on the return to town in the fall, when the house has been closed for some time; also when typhoid fever in the neighborhood indicates the strong possibility of the impurity of the water-supply.

The mistake should not be made of undoing the good that has been done by boiling the water by the addition of ice to the water when it is placed on the table. Furthermore, ice-water is so cold that it retards and interferes with the digestive processes.

In the internal use of water the same marked difference is caused by the different temperatures at which the water is taken, as was seen in the external applications of

water; but, while the temperature of the skin is about 90° F., that of the mucous membrane lining the digestive tract is 98.6° F. and above.

The Action of the Internal Use of Water on the Heart and Blood.—Water improves the quality of the blood, both by its direct action on the constituents and by the increased elimination of waste-products. By the increase of the volume of blood, a more energetic contraction of the heart is caused, and the activity of all the glands of the body is increased. There is a greater amount of oxygen absorbed by the lungs; oxidation in the tissues is carried on more perfectly, the result of which is that there is a diminution or absence of the products of incomplete combustion in the body, such as uric acid, the oxalates, etc.

By the increase of the blood-pressure, caused by drinking water in sufficient quantities, the activity of the kidneys is increased, and this not only in the amount of urine passed, but also of the solid constituents, which are the waste-products, removed from the body through the agency of the kidneys.

The Action of Water on the Digestion.—Very little water is absorbed from the stomach; it passes from the stomach to the intestines, where it is absorbed. In order to obtain a thorough cleansing of the stomach, and at the same time not to cause its overdistention, not less than ½ pint of water and not more than 1½ pints should be taken at one time. The water must be taken one hour before meals, in order to insure its removal from the stomach and the proper rest of that organ before food enters it, as it has been found by actual experiment that in a quarter of an hour after water had been taken one-half of the quantity remained in the stomach, but that none remained after the lapse of half an hour. Cold water is more quickly absorbed than warm, and the absorption is hastened by the presence of carbonic acid, while salt of any kind delays its absorption.

The Therapeutic Indications for the Use of Water.—First, the temperature of the water taken must be regu-

lated by the effect desired. Briefly stated, if the water is taken for dyspepsia in any form, whether acute or chronic catarrhal inflammation of the stomach or the intestinal canal, ½ pint of water, just as hot as it can be sipped with a spoon, should be taken three times a day, one hour before each meal.

No water should be taken during the meal, and only one glass, at a temperature of about 60° F., on its completion.

If the water is taken as a diuretic, or, in other words, to increase the activity of the kidneys, the most of the water should be taken in the morning on rising and the remainder about 4 o'clock in the afternoon. Probably the best natural waters for this purpose are the waters of the Vosges, France. The Vittel water, "Grande Source," acts on the kidneys alone; where the bowels are regular or inclined to be loose, this is the best water to use. If, on the contrary, there is constipation or biliousness, the "Source Salée" should be taken in connection with the first named or alone. The "Source Salée" has a decided action on the liver and is laxative.

In order to obtain a pronounced effect, at least 3 pints of these waters should be taken daily; in some cases more is required. Two glasses may be taken on rising in the morning, with an interval of twenty minutes between; the last glass must be taken one hour before breakfast. The temperature of the water should be 50° F., which is the temperature of the water at the springs and that of the water when placed in bottles in the refrigerator against the ice. In the afternoon the other two glasses may be taken, with the same interval between.

In gastric catarrh, where there is an accumulation of mucus or fermenting matter, with or without nausea and vomiting, hot water alone is useful. In addition to its action in diluting the contents of the stomach and the intestines, and its cleansing and antiseptic effect on their mucous membranes, the reflex effect of very hot water, slowly sipped, is a stimulation of their muscular coats,

which furthers the passage of the digested food from the stomach into the intestines. The quantity taken must be from ½ to 1 pint, in order to obtain a thorough cleansing and yet not to cause an overdistention of the stomach.

In acute nephritis, inflammation of the kidneys, small quantities of very cold water, repeated at half-hourly intervals, act as a diuretic. Care must be had, however, not to overtax the stomach and heart by overfilling the system with fluids.

In obesity, water-drinking is essential as a means of dissolving and carrying out of the body the large amount of broken-down material which results from the increased tissue destruction caused by exercise, hot and cold baths, and other means employed to decrease the weight.

For constipation and biliousness two glasses of cold water should be taken before breakfast, with an interval of twenty minutes between, the last glass being taken one hour before breakfast.

Contraindications.—Cold water taken into the stomach produces more marked effects than water applied to an equal area of the skin. The quantity of water taken is a factor as well as the temperature. Cold-water drinking lowers the temperature and slows the pulse, so that drinking cold water must be strictly prohibited when one is in a state of fatigue, whether perspiring or not. Feeble persons should not drink cold water, except in very hot weather, or just before starting out for a brisk walk in the open air, or when about to engage in other exercise. With the air of the room at 70° F., a woman in fair condition, moving about making her toilet, may safely drink cold water slowly, except when there is a feeling of chilliness. In the latter case, the powers of reaction being diminished, chill and internal congestion, often resulting in great injury, may be produced. Cold-water drinking is always prohibited when in a state of fatigue. Ice-water should never be taken. When taken with meals, it greatly retards digestion and may do much harm.

Enemas.—Coloclysters.—Another valuable internal use of water is for emptying the lower bowel, and washing out the large bowel in cases of catarrhal inflammation.

For constipation, in which the object is to unload the bowel as quickly as possible, 1 or 2 pints of water, at a temperature of from 104° to 110° F., is made into a suds by means of Castile or other good soap, and poured into a fountain-syringe. If the enema is being given by an attendant, the patient lies on the right side in the Sims' position; the under leg is stretched out so that it forms a straight line with the trunk, while the upper leg is sharply flexed at the knee, so that the foot is opposite the knee of the under leg; the right arm is thrown back from under the body.

If the patient is administering the enema to herself, the best position is the knee-chest. In this the patient kneels on the floor, the thighs are held rigid, and while the shoulders are brought to touch the floor, the face is turned to one side. The position can only be taken satisfactorily with the corsets and all tight bands around the waist removed. In this position gravity causes the intestines to fall upward toward the waist, and the water naturally follows this course. In this position the water goes up higher, and is retained longer, than when taken in the other positions. Two pints of the soap-suds are prepared at the proper temperature, and the patient uses as much of this as she feels that she can retain. The water should be retained from five to ten minutes, to get the best results.

For the purpose of washing out the large intestine more water is used, but not more than 2 quarts should be used for this. The position of the patient and the temperature of the water are the same. But for this clyster, instead of adding soap to the water, cooking salt is used, in the proportion of 1 teaspoonful of salt to 1 pint of water.

This lavage of the intestine removes rapidly large masses of decomposing material, swarming with microbes and ptomains and the toxins produced by them. It also increases the activity of the portal circulation.

In cases of chronic constipation there are atony and dilatation of the colon, and the patient always carries about with her an enormous accumulation of fecal matter, and lives in a state of chronic autointoxication. In this class of cases the coloclyster should be administered daily for from two to three weeks; if need be, so long as the patient complains of gaseous distention and fetid flatulence. After the discharge of the warm water, 1 pint of cool water should be introduced, beginning with a temperature of 85° F., and gradually decreasing this from day to day until 70° F. is reached. This water should be retained if possible; it acts as a tonic bath for the colon.

Care should be exercised to avoid the distention of the colon by an excessive amount of water, and, after the colon has been thoroughly cleansed, the amount of water used should be decreased from day to day, until finally only 1 pint is used. Warm water is always relaxing, whereas cold water stimulates and tones up the bowel. If the quantity of water used is small, the cold coloclyster may be used indefinitely without producing constipating effects.

Great care must be used to avoid the introduction of air into the bowel with the water; to this end the water is allowed to run out of the nozzle before its introduction into the rectum. A small-sized nozzle should always be used, and this should be lubricated with vaselin or some other emollient, in order to prevent irritation of the mucous membrane.

Vaginal Irrigations.—To be of any service the vaginal douche should be taken in the horizontal position. It may be taken on the bed, couch, or lying on the floor. When taken on the floor, a heavy rug or steamer blanket should be doubled four times, and two pillows are used: the under one goes up and down for the support of the back, while the second is used for the support of the head. A douche-pan is, of course, indispensable. The agate pans holding 4 quarts of water are the most serviceable. The douche-pan is placed against the lower edge of the under

pillow, which is protected by a bath-towel. The woman must throw a heavy shawl or blanket over herself while taking the douche, otherwise there is great danger of becoming chilled, and thus doing actual harm instead of good.

The most common and best form of syringe is the fountain-syringe. This is hung about 6 feet above the bed or floor. It should hold 4 quarts of water; this quantity of water is necessary when the douche is given, as it most commonly is, for pelvic inflammation. On beginning its use, the temperature of the water must be controlled by the sensitiveness of the patient; generally one can use a temperature of at least 112° F., but not always; sometimes one must be content with a beginning temperature as low as 104° F., gradually increasing the temperature by two degrees every few days, until from 114° to 120° F. is reached. The use of a bath thermometer is always essential to test the temperature of the water. The temperature of the douche should never go above 120° F., or actual harm will be done.

On lying down, the lower part of the body rests on the broad strip of the douche-pan, the nates coming over the edge, and the clothing well pushed up, otherwise the water will seep up the back.

The water acts as a hot poultice about the uterus and its adnexa; it is also astringent, and greatly relieves ovarian irritation and congestion. It is highly sedative, and is best used at night just before retiring. In severe cases better results will be obtained by its use twice daily. In that case one douche must be taken in the morning, but in cold weather it must never be taken immediately before going out-of-doors; there must be at least one hour between the time of taking the douche and going out into the cold air. Patients taking hot douches must be warned that the pelvic viscera are much more susceptible of chilling because of these heating procedures, and of the necessity to counteract this tendency by the wearing of woolen abdominal bands, both night and day.

Ordinarily, plain hot water is all that is necessary to use, but if the vaginal discharge is irritating, one teaspoonful of borax may be added to the pint of water; or one teaspoonful of cooking salt; or one-half teaspoonful of the sulphate of zinc.

Douching the Ear.—This procedure is made use of to remove impacted ear-wax or to relieve the pain of earache. A small fountain syringe should be used, hung not more than 3 feet above the head. The water should have a temperature of from 105° to 110° F. The nozzle must be small, and have a very fine opening, and great care must be used in its introduction not to allow the nozzle to enter beyond the external opening of the ear. A pus-basin or small dish may be used to protect the clothing from getting wet. After the procedure is finished, the ear is dried by means of a very fine handkerchief or a little absorbent cotton.

CHAPTER III

THE CARE OF THE SKIN AND ITS APPENDAGES

The Complexion; the Action of the Bath in Health; the Proper Time to Bathe; the Care of Wash-cloths; Cleansing the Face; Protection of the Face; the Use of So-called Cosmetics for the Face; Facial Blemishes, Freckles, Liver Spots, Sallow Complexion, Pimples, Acne, Eczema, Wrinkles, and Their Treatment; the Relation of Diseases of the Skin to Internal Disorders.

The Hair; Dandruff; Causes and Treatment of Premature Thinness of the Hair and Baldness; the Care of the Hair; Gray Hair.

The Cosmetic Care and Treatment of the Hands; Cosmetic of the Nails; the Care of the Feet; Painful Affections of the Feet.

The face is a complete index of the life of the individual written large, so that he who runs may read. By looking at the condition of the skin and the whites of the eyes we can judge very fairly of the digestion. From the dulness or brilliancy of the eyes we can make a very good diagnosis of the mental condition. From the general expression of the face we can read the kind of life that has been led by the individual, whether of pleasure, dissipation, or sorrow.

From greatest antiquity men and women have striven to beautify their bodies. To be indifferent to the personal appearance is an indication of some abnormal condition in the individual or her environment.

The Complexion.—The skin of the face is known as the complexion, and this is the part of the skin that is most exposed to the vicissitudes of dust and grime of the streets or of the occupation, as well as to heat, cold, and winds.

An ideal complexion combines the qualities of clearness, translucency, and fineness of the outer skin, with a proper disposition of the blood-supply.

The beauty of the skin is evidence of good respiration, good digestion, proper excretion by the bowels, skin, and kidneys, good condition of the blood, and plenty of outdoor exercise.

It is now well known that the skin, as well as other parts of the body, depends for its integrity upon the general nervous system. Disturbance anywhere in the body acts upon the central nervous system. A simple case of indigestion often manifests itself over considerable areas of the skin.

It cannot be too earnestly impressed on the reader that beauty is entirely dependent on the health. It will readily be seen that no external applications can produce such qualities as fineness of texture, translucency, and delicate play of coloring produced by the contraction and dilatation of the blood-vessels.

The natural order in which to consider the skin will be first as subservient to health, and then as it is conducive to beauty.

The Action of the Bath in Health.—Not only in the art of pleasing, but in the maintenance of health, neatness of person must be carried to perfection. By the use of friction, soap and water, the scarf-skin becomes more and more constantly renewed by the layers underneath it. It becomes softer, more pliant, and finer than satin in appearance and texture. Besides this, as has already been shown, bathing has upon the corium or true skin, and thence upon the general system, a revitalizing influence. Combined with the proper kinds of soap, avoiding the use of irritating ones, bathing removes from the skin all effete oily matters, scales of the scarf-skin, crusts, the saline matters excreted by the perspiration, dust of all kinds, soot, particularly that from the clothing, and so forth.

Caustic soaps and borax in excess may remove the oil in so great quantities as to be detrimental to the skin.

Within twenty-four hours the skin, especially those

PLATE I

Facial expression.

parts which are covered, becomes vested with a pellicle of impurities, which, when allowed to remain, become thicker every day, and may produce injurious effects by obstructing the excretory openings and affording lodgement for disease. The effects would be felt not only in the skin, but in the whole organism. The skin when not cleansed will be irritated chemically and mechanically.

The Proper Time to Bathe.—This depends on the nature of the bath to be taken, the strength of the woman, the temperature of the room, and the season of the year.

To repeat, a cold bath of any description must never be taken unless the body has a decided sensation of warmth. In winter, if she will drink a glass of hot water before rising and has a warm room, the woman in average health may take a cold sponge bath. But the body must be very gradually trained to the application of cold, just as it is to vigorous muscular exercise. For the woman who has never in her life taken a cold bath of any sort, except in midsummer, to begin a heroic treatment with cold baths in winter would be utter folly, which might easily be the cause of pneumonia and even of death. The time to begin a systematic use of cold water is in summer, continued through the autumn, and by the time midwinter has arrived, the system has become so toned up that nothing but good can result.

If the woman is not very strong, she had better begin with the cold ablutions, just to the waist, on rising in the morning. These must always be followed by a vigorous toweling and friction. In case of inflammation of the kidneys or pelvic viscera, cold applications to the abdomen should be avoided, as they are badly borne.

If the woman is anemic, has a poor circulation, or is conscious of her heart, she will feel at her best in the afternoon. In that case, after a cup of hot bouillon, taken on rising from her siesta, she may take a quick hot scrub, followed by a cold shower. This is much more invigorating than the cold ablution, and the reaction at that time of the day is more vigorous than in the early morning.

From the simple ablution, the next step in training would be the cold wet sheet. It is impossible to take this without an attendant, but a good maid may readily be taught to give the necessary rubbing. Ordinarily, this will be enough to attempt in one winter.

A strong woman, who has always been accustomed to taking cold baths, may all the year round, except just before, during, and immediately after the menstrual period, take a cold dip on rising in the morning. It must be literally a quick dip in a tubful of cold water, from 65° to 55° F., or, if she is sufficiently strong to stay in the tub longer, there must be a constant brisk friction kept up while in the water.

It is permitted only a woman in good health, with a strong heart and normal kidneys, to get into a tub of cold water, take a cold plunge, or attempt sea-bathing.

For the woman who is a semi-invalid, the only time allowable for a cold tonic bath is in the afternoon.

In cold weather the shower, like all other forms of baths, must be taken in a warm room. The shower bath can be taken every day to the greatest possible advantage. An ideal way is to rest for half an hour on coming home in the afternoon; to sleep, if possible, then take a quick scrub, and follow it first by the hot shower of 100° to 104° F., and finish with the cold shower. A brisk rubbing should be kept up until the skin is in a good healthy glow. This bath is followed by a feeling of great exhilaration, and it gives a beautiful glow to the face and skin. It removes the tired feeling of the day's work, and leaves one feeling greatly refreshed for the evening. A daily ablution or a daily shower, with friction, will not cause an undue removal of the oil of the skin. All cold baths, when given in suitable cases, tone up the system to resist disease, and are the best preventives against ordinary colds and sore throat.

A hot tub-bath is best taken at night just before retiring. In winter it must never be taken immediately before

going out-of-doors, because the pores of the skin are more or less open and there is great danger of chilling. A hot tub-bath, remaining in the bath for some minutes, should not be taken more than twice a week, as it is too debilitating, and a prolonged stay in the hot water causes an actual loss of flesh.

A woman may take a warm sponge bath in a warm room at any time of the month, but during the menstrual period she must, under no consideration, take a cold tub-bath or even a cold sponge-bath, since this would be apt to cause a chill of the surface of the body and a congestion, if not an actual inflammation, of the pelvic organs.

No bath should be taken within two hours after eating, as the bath draws the blood from the stomach toward the surface of the body and so interferes with digestion.

The Care of Wash-cloths.—After using each time, the wash-cloth must be thoroughly washed, well rinsed, and hung up to dry. But this is not sufficient: once every week all wash-cloths must be sent to the laundry to be boiled, thus insuring the destroying of any germs that may lurk in the cloth. If a woman has any kind of skin disease, it is quite possible for her to reinfect herself after the disease has apparently become cured. Further, each member of the family should have her own individual towels, soap, and wash-cloths. Aside from all sanitary questions, in a matter so intimate as the bath, there is something repulsive in the thought of having your toilet articles used by any one else.

A pure Castile soap is one of the best that can be used. All cheap scented soaps should be avoided, as they are apt to contain impure materials that will actually injure the skin. If the skin is rough, rubbing it with a good sand-soap, and rubbing the same on the flesh-brush, will remove many of the scales and leave the skin much smoother and softer. Medicated soaps should never be used except by the direction of a physician.

Cleansing the Face.—The face should be well washed

twice a day with cool or cold water, but the temperature of the water should not be below 60° F. The degree of coolness must be determined by the feelings and judgment of the individual. If the face were washed with very hot or very cold water, and then exposed to the cold air, the skin would become rough and chapped. The water should be soft. To soften hard water, put 1 pound of bran into a muslin bag, place in 4 quarts of water, and boil for fifteen minutes. Add enough of this bran water to the bath to make the water milky.

A soft, woven face towel, kept for the face and neck only, should be used with a moderate degree of friction. Great care must be used to wipe the skin thoroughly dry.

It is a question whether the daily use of soap on the face is advisable; for the healthy skin it is not essential and may prove very injurious. Soap should never be used on the face in winter just before going out-of-doors, as this would cause a roughening of the skin. When the hot tub-bath is taken, the face should be well washed with soap and hot water, plenty of friction being applied by means of the face towel, after which the face is thoroughly rinsed with pure water. This will open the pores of the skin, and should be followed by the use of cold water, which has a stimulant action on the blood-vessels and improves the circulation in the skin. It also improves the tone of the elastic fibers in the skin and tends to delay the appearance of wrinkles.

If there is any tendency to dryness of the skin, a good cold cream should be well rubbed in just after bathing the face. The cream must be a good quality and perfectly fresh, as a rancid cream is irritating to the skin. Only so much of the cream should be applied as will be absorbed by the skin. When the skin is very thin, and there has been loss of subcutaneous fat due to ill health or other cause, the systematic application of cream in this manner aids in the nutrition of the skin; and, when applied to the

neck with good massage, is a great protection against sore throat due to exposure to drafts and cold.

Protection of the Face.—The cold winds of winter cause a dryness of the uncovered skin of the face and lips, which often leads to a painful chapping, and, in the case of the lips, small fissures may be produced. In addition to the use of cold cream, a good rice powder may be applied, which serves as a further protection to the skin.

In very cold weather a veil should be worn to protect the face from the cold and winds. In summer a parasol should always be carried, to protect the eyes and brain as well as the face from the hot rays of the sun.

The Use of So-called Cosmetics for the Face.—All skin specialists, and these are in the very best position to judge of the great amount of harm that is done, say emphatically that the use of face lotions and "paints" can only work the lasting injury of the complexion. They may assist in hiding the defects of nature, but they frequently contribute to increase these defects. Many of them merely fill up the pores of the skin and give it a pasty look. Numerous cases of eczema and other diseases have followed the use of paints. Of the advertised cosmetics, many are not only worthless, but actually injurious.

Certain applications to the skin of the face are permissible and beneficial. "Virgin milk," which is a milky-looking mixture, composed of the tincture of benzoin and rose-water, renders the skin soft, and is said to prevent the formation of freckles. If the skin is dry, glycerin may be added to this. The formula for this mixture is as follows: Take of the tincture of benzoin and glycerin each 1 ounce, mix well, and then add 2 ounces of rose-water. This should be applied by the fingers, just after the face is washed. Pure glycerin is irritating, and should never be applied to the face without dilution.

The various good preparations of rice and talcum powder on the market are perfectly harmless, and, if there is a

tendency to greasiness or shininess of the skin, the use of these is essential from an esthetic point of view. In case of greasiness a little calcined magnesia may be used. In hot weather the use of face powder is very refreshing, and in the hot climates it is used for this purpose to a very striking extent. But the true cosmetics, and the only ones that can procure and keep a beautiful complexion, are plenty of exercise in the open air, attention to the diet, to the daily evacuation of the bowels, to the condition of the kidneys, to baths, and to proper dress.

Facial Blemishes.—Among the most common facial blemishes are freckles, liver spots, a sallow complexion, pimples, acne, eczema, superfluous hairs, and wrinkles.

Freckles.—These are brownish or yellowish pigmentary spots, varying from the size of a pin-head to that of a pea. They occur on the face and the backs of the hands. They consist of a circumscribed deposit of pigment; not much is known about their origin. The pigment is situated in the deep layers of the epidermis, and, in order to remove the freckles, it is necessary to use something capable of producing desquamation. As a rule, if left alone, they will gradually disappear.

Liver Spots.—The so-called liver spots are irregular patches of a brownish color, which appear most frequently on the face, neck, chest, back, arms, and hands. If not caused by disorders of the liver and digestion, they are certainly aggravated by them. They are not only unsightly blemishes on the skin, but sometimes cause great nervousness by the intense itching which accompanies them.

Sallow Complexion.—This is generally caused by disorders of the liver, and is most frequently met with in hot countries. It is seen in chronic dyspeptics, and, indeed, in most forms of chronic disease, and is not only a symptom of the disordered bodily state, but a cause of its perpetuation. This appearance of the skin is due to the accumulation of effete matters in it and to its impaired nutrition, and this state exists not only in the skin, but in the whole body.

Pimples, or Blackheads, and Acne.—These are affections of youth, and are generally seen together, the last-named being simply a second stage of the first. Pimples, or blackheads, appear as small elevations in the skin, with a small black point in the center. The cause of the pimple is the alteration in the quality of the sebum, the oily secretion, which becomes and remains a hard mass in the excretory ducts of the sebaceous glands and plugs up its external opening. The dust of the air becomes mixed with the fat, and thus makes a black point. When the ducts cannot get rid of the sebum, they become stopped up, and in consequence become swollen. This irritation spreads to the adjacent tissues, and so inflammation arises. Finally, the contents of the duct undergo degeneration, suppuration occurs, and the contents become mixed with pus, small abscesses result at various depths in the skin, and so require more or less time to break out.

This inflammatory condition of the sebaceous glands with their ducts is apt to become chronic and may prove an obstinate affection. It occurs most commonly about the face, on the back between the shoulders, or on the chest. The skin is rough to the touch, the ducts of the sebaceous glands are enlarged, and the skin is greasy.

Eczema.—This is the most common of all skin affections. It is a non-contagious, inflammatory disease of the skin, sometimes acute, but more often chronic, attended with itching and desquamation or loss of cuticle. With the itching may be a feeling of heat and tension in the part.

Eczema is a local disease, brought about by a local irritation in the skin; but, in addition to this, there is generally a predisposing cause, as some disorders of the digestive tract, a bad condition of the blood, and so forth. The skin, like other organs of the body, depends on the whole system for its nutrition. When this nutrition is not sufficient, the skin appears pale, of a peculiar color, and is easily taken up in folds, an evidence of poor nutrition of the skin. When the skin is not properly nourished, every slight irritation is liable to produce eczema.

Treatment of Liver Spots, Sallow Complexion, Pimples, Acne, and Eczema.—First, the general treatment. While every case of skin disease must be treated according to the peculiarities of that patient's case, still, there are general rules which should be followed in the treatment of all cases, and first in importance comes attention to the bowels. There must be procured, by some means or other, a free daily evacuation. A hard, constipated movement is not sufficient. Fruits and vegetables are both laxatives and the very best. Water is also a laxative, and 3 pints a day should be taken, not only for the laxative effects, but also because this amount is needed to keep the kidneys properly flushed. Of the simple medicinal laxatives, one of the best is the effervescing granules of the phosphate of soda; the dose is from one teaspoonful to one tablespoonful, to be taken in a glass of cold water on rising in the morning. Sometimes patients who are troubled with gas cannot take anything which effervesces; in that case, the plain phosphate of soda may be substituted.

Next in importance to the attention to the bowels comes the diet. All articles of diet must be easily digested, while at the same time they are nourishing. Cereals, pies, pastry, fried foods, hot breads, rich gravies, rich salads, pork, and veal must be excluded from the bill of fare.

Fresh meat must be eaten by a woman in health at least once a day, and young girls need it twice a day. This should be supplemented with eggs and milk, fresh vegetables, and not an excess of stale bread or toast. The latter is constipating. Tea and coffee should both be avoided.

A glass of hot water, taken one hour before meals, will do much to rid the stomach of mucus and put it in a good condition for the digestion of the food.

For the congestion of the liver, which is so often at the bottom of these disorders, it is generally necessary to consult a physician.

Pure air, associated with the proper kinds of exercise, promotes the functions of the skin, assists in keeping the blood in good condition, increases the vigor, keeps the complexion clear and increases its beauty; while, on the other hand, a sedentary life in a confined air produces a pallid and frequently a blotched skin, with headache and dyspepsia.

Steaming the Face.—It seems that the blood-vessels of the skin are much better able to absorb vapor than water. The vapor penetrates and softens the epidermis much better than the simple application of water would. The increased secretion from the skin which is thus caused is beneficial. After using the vapor bath the outer layers of the epidermis peel off and the complexion is improved by the substitution of new pigment. The absorption of the moisture also causes a roundness of the skin and a filling out of the wrinkles. Generally, vapor baths can be used in those cases of skin diseases where the skin is rough and dry. Next in importance to the vapor bath is steaming the face. Bathing the face with very hot water is also recommended.

Massage of the Skin.—Where the complexion is sallow, or there is a tendency to pimples or blotches, massage of the skin of the face will do much to improve the circulation.

The massage is most effective when it follows steaming or washing the face in hot water. The tips of the fingers should be dipped in cold cream, and then, pressure being exerted by them, the skin of the forehead should be deeply stroked from the middle line out over the temples. The nose should be stroked from the bridge outward and downward. The skin of the cheeks should be pinched up and rolled between the fingers and thumb. All these movements facilitate the emptying of the follicles.

Never use an ointment on the face that contains vaselin or lanolin, but particularly the former, as they are both apt to produce a growth of hair, but these preparations are excellent to increase the growth of the eyebrows.

Wrinkles.—In very many cases wrinkles are the result of habit of expression, as in scowling; or an expression of

dejection, when the angles of the mouth curve downward, and so forth.

There are twenty-eight muscles about the mouth. Since all these muscles are developed by use, the mouth comes to assume the expression given to it by the thoughts of the individual. The figurative expression, "down at the mouth," comes to be literally true, and the angles of the mouth are seen to be habitually drooping, until at last this is the fixed expression of the face. A healthy frame of mind is the only means to keep the face from

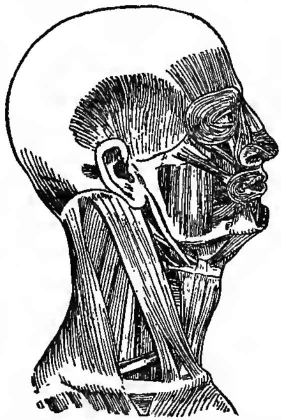


Fig. 3.—Muscles of the right side of the head and neck.

being converted into a map of wrinkles and drooping angles at the mouth.

The wrinkles are not, as a rule, caused by any trouble in the skin itself, but in the underlying muscles, the tissues of which have become relaxed or weakened. The circulation of the parts may be stimulated, and so increased nourishment be secured by deep massage of the muscles, and, at the same time, the use of a good cold cream will aid in the nourishment of the skin.

The face should first be washed and steamed according to the directions already given. The massage of the face

should always be carried out in a systematic manner. Begin with the forehead. Stroke with the two thumbs over the forehead, starting near the eyebrows, and work out toward the roots of the hair. In the second movement one hand is used to stretch the part worked upon, while deep friction is made with the tips of the fingers of the other hand.

For wrinkles about the eyes, stroke with the tips of the fingers, over and below the eyes, from the nose toward the temples. Great care must be taken not to apply too much cold cream about the eyes, lest some of it should get into them. For the removal of the "crow's feet" at the outer angle of the eye stretch the part with the thumb and finger of one hand, and perform friction with the tips of the fingers of the other hand.

To remove the lines that run from the corners of the nose to the angles of the mouth, stroke with both hands, one on each side of the face, beginning at the center and lower part, and stroke upward toward the temples. This upward motion counteracts the drawn and pulled-down condition of the face.

For the cheeks, use both friction and deep kneading; pick up the muscles between the thumb and finger.

To remove wrinkles under the chin and a double chin, begin at the middle line, and with both hands make deep pressure upward and outward. To remove superfluous fat, make deep friction with the tips of the fingers. In the latter case, only use enough cocoa-butter on the fingers to prevent the friction against the skin. The benzoin preparations, already given, will help to contract the tissues.

A cold cream which is a good skin food is the following: Take of the oil of sweet almonds, 2 ounces; of spermaceti, ¼ ounce; of white wax, ¼ ounce; and of rose-water, ½ ounce. Melt together at a moderate heat, the oil, spermaceti, and wax, then gradually add the rose-water; stir the mixture briskly and constantly until it is cool, and continue the stirring until it has become uniformly

soft and creamy. The Dover egg-beater will give it the desired creamy appearance.

The Hair.—From an esthetic point of view, a head of luxuriant hair is a matter of prime importance to the woman.

The hairs are peculiar modifications of the epidermis. The hair follicle is a cylindric-shaped depression of the skin, whose funnel-shaped mouth opens on the free surface. Immediately below this is a constriction, called the neck, which is the narrowest part of the follicle; the duct of the sebaceous gland, which supplies the hair with oil, opens at this point. The base of the follicle is bulb-shaped, to accommodate the hair-papilla and the hair-bulb. The hair-papilla contains the blood and nerve supply for the hair. When a hair is plucked or falls out, a new hair grows from the hair-papilla.

According to Pincus, the life of a hair ranges from two to six years, after which it falls out, to be replaced by a new one. In this way about fifty or sixty hairs are normally shed every day.

In order to have thick, luxuriant, silky hair great attention must be paid to the condition of the scalp, since it is the scalp which contains the blood-vessels that nourish the hair. The scalp should be thick and pliable and move freely over the bones of the skull. If the scalp is drawn tightly over the bones of the skull, it tends to constrict the blood-vessels, and so lessen the supply of blood to the scalp and cause atrophy of the roots of the hair from pressure.

The hair has a great tendency to accumulate dirt. It catches the dust flying in the air, and also retains the secretion of fat and the desquamated epithelium of the scalp and the products of perspiration.

The two chief causes of the premature thinness of the hair are a deficient circulation of blood in the scalp and dandruff, and it is said that dandruff causes the loss of hair in 70 per cent. of all cases.

Dandruff.—The last few years has witnessed a revolu-

tion in the views of the skin specialists in regard to the cause of dandruff. Previous to that time it was considered as simply a collection of epithelial scales mixed with more or less oily matter. Now, following the investigations that were first instituted by Unna, dandruff is considered as a symptom of a parasitic disease of the scalp, called seborrheic eczema. Sabouraud believes that the same parasite that produces seborrhea causes the loss of hair. It is believed that the parasite grows down into the hair follicle, between its walls and the hair.

Seborrheic eczema is a chronic desquamative inflammation of the scalp of bacterial origin. It is divided into two stages: the first may last from one to seven years; it is attended with more or less dandruff in the form of scales and dryness of the hair; or the dandruff may unite with the oil, producing fatty crusts which are removed with difficulty. This is followed by the second stage, in which the hair falls out.

Symptoms of Seborrheic Eczema.—In the dry form of the disease, in which there is a scaling of the scalp, the hair is dry and unmanageable, the head itches, especially when the patient sits under a light or becomes overheated. There is a more or less constant falling of the scales upon the clothes. The scalp looks pale, and will be found covered with fine grayish or yellowish, readily detachable scales. Sometimes there is more or less redness of the scalp. This is the mildest grade of the disease.

That dandruff is contagious has been proved by experiment, experience, and treatment. Lassar and Bishop made a pomade of the scales taken from the head of a student who was suffering from this disease, and rubbed it into the backs of guinea-pigs, which caused the same disease in them, and falling out of the hair.

Cases have been reported in which husband and wife have contracted dandruff after marriage, he or she having been free before.

The drugs that are most efficacious in the cure of seborrhea are active antiparasitics.

Causes of Seborrheic Eczema.—The general causes are debility, constipation, and anything which undermines the general health. The local causes are lack of cleanliness of the scalp, and using combs or hair-brushes which have been used on the scalps of persons who were suffering from this disease.

In most families will be found one or more members who possess enough seborrheic infection to cause the spread of the disease throughout the rest of the household.

Causes and Treatment of Premature Thinness of the Hair and Baldness.—It has already been stated that 70 per cent. of these cases were caused by seborrheic eczema. Among other causes may be mentioned a progressive tightening of the scalp upon the skull, the scalp having lost the cushion of fat that is under it in early life; insufficient or improper care of the scalp; daily sousing of the head in cold water, combined with improper drying of the hair afterward; sweating of the head; constant mental strain, either on account of intellectual work or worry; wearing stiff, unyielding hats; gout, and all diseases which lower the general nutrition.

The chief treatment is by prophylaxis, or using preventive measures to insure the healthy condition of the scalp. And first and most important of these is cleanliness. Because of the great length of time which it takes to dry long, thick hair, many women do not wash the scalp often enough. In the healthy state of the scalp it should be washed at least once a month.

The Care of the Hair.—There is never any danger of shampooing the healthy scalp too frequently. The oil in the scalp is not removed by washing, but is, on the contrary, always increased through the improvement in the circulation. Where there is much dandruff, or if the hair has begun to fall out prematurely, owing to long neglect or following an illness, it is well to begin by washing the hair two or three times a week, and then gradually increase the interval to every two or three weeks.

Borax in the water cleanses the scalp well, but its continuous use is injurious; the same may be said of ammonia water.

One of the best shampoos is the tincture of green soap. If this cannot be obtained, take of the official green soap 2 ounces, and of alcohol, 1 ounce; mix well, and make shampoo. One ounce of the tincture or its substitute should be diluted with twice as much water and applied to the scalp with the tips of the fingers. When enough of the shampoo has been used, add sufficient water to make a good lather. This must be thoroughly rubbed into the scalp, going over the whole systematically. After the scalp is cleansed, the soap must be well rinsed out of the hair. This may require many changes of the water, but it is most important. Dry the hair with hot towels, the process being completed by a radiator or stove oven. Fanning the hair will hasten the process very considerably. The hair should then be loosely braided and a hot towel wound around the head to insure perfect dryness of the hair and as a prevention against taking cold. One hour is sufficient for the entire procedure. In winter the hair should be washed just before retiring.

Brushing the Hair.—Brushing increases the growth of the hair by stimulating the circulation in the scalp and by removing the dandruff. To be effective, the hair should be well brushed at least once a day, when there must be a deep brushing of the entire scalp. The bristles of the brush must be stiff enough to warm, but not to scratch, the scalp. Brushing and massage remove any loose hairs that are ready to fall, but they will soon be replaced by new vigorous ones.

Combing simply disentangles the hair. The teeth of the comb must be far apart and have rounded ends. In no case should a fine-toothed comb be used. It tears out the hair, and often causes an irritation of the scalp which leads to disease.

From what has been said, it will be seen that every member of the family should have a brush and comb for

her own exclusive use, and that no one should allow a public brush or comb to be used on her head.

The brush and comb must be washed once a week in water containing a little ammonia; they must be well rinsed out in pure water; the brush should be dried quickly, with the bristles down. If the brush and comb are not cleaned sufficiently often, the scales of dandruff would be sufficient to reinfect the scalp.

Massage of the Scalp.—The scalp should be thoroughly massaged every night. Grasp the scalp with both hands laterally, as well as anteroposteriorly, and with some pressure loosen the tissues from the underlying parts and try to raise it in folds, or it may be pinched with the forefingers, producing some vascular flux and a sense of warmth.

If the scalp is too dry, nothing is better than pure vaselin, though some persons prefer olive oil, applied by means of a dropper. The yolks of eggs beaten up with lime-water make an elegant shampoo.

Dressing the Hair.—Dragging or twisting the hair from its natural direction, pulling it into constrained or artificial positions, and even twisting the hair very tightly is injurious to it.

The curling iron acts by abstracting more moisture on one side of the hair than on the other. The stronger the hair, the more easily it will curl, and the longer it will stay curled. The daily use of a hot iron, notwithstanding the greatest care, will in a short time prove injurious; the hair is apt to become thin and fall out. Its growth is interfered with. The use of kid curlers is much less injurious, but even here the tight twisting of the hair around the kids is said to be harmful.

Shell hair-pins are the best for the hair. If steel ones are used, the points must be smooth and the pins kept in good condition.

When the hair is dressed for the night, after the scalp has been brushed and massaged, it should be loosely braided and left hanging down.

Cutting the hair 1 inch, every two or three months, is

said to promote the growth of the hair and prevent its splitting. It does not increase the number of hairs.

There is no truth in the assertion that the hair is a hollow tube, which allows the escape of oil, and that if the ends are sealed by singeing much good will result.

Gray Hair.—Grayness of the hair may be either premature or physiologic. When the grayness is due to some temporary cause, as anxiety or some diseased state, the process may cease completely on the removal of the cause. Usually the whitening is permanent. The grayness of the hair is caused by obscure changes in the nutrition of the hair-papilla, which interfere with the production of the pigment. As a rule, the hair whitens first on the temples, then on the top of the head.

The hair first turns gray at its root. The grayness is due to the loss of pigment. Prolonged residence in either a very cold or a very hot climate will cause the hair to turn gray.

A yellowish tinge of the hair is sometimes seen in patients with jaundice, or gray hair may owe its dull yellow color to the tint of dry albumin of which it is composed. The glitter of steel-gray or silver-white hair is due to the high refractive power of the minute air-bubbles that lie in the substance of the hair.

Treatment.—The color cannot be restored to gray hair. The roots of the hair are embedded in the hair follicles, and cannot be reached by any fluids applied to the scalp. Not only is the use of hair-dyes to be deprecated as an exhibition of poor taste, which happily is going out of fashion, but the use of hair-dyes is extremely dangerous. Cases are being constantly reported by physicians, where the use of these supposedly simple vegetable hair-dyes has been followed by very serious and extensive dermatitis of the face, neck, and shoulders.

Gray hair is really very beautiful when it is of silvery whiteness, and very ugly when it is of a yellowish-white color. It must be treated with much greater care, in

order to preserve its silvery whiteness, than was necessary to keep the hair in good condition before it lost its coloring pigment. It should never be wet, except when it is shampooed. For this reason, instead of using hair-curlers, crimping pins should be used. In this way the hair is waved quite as well and the use of water is avoided.

The Cosmetic Care and Treatment of the Hands.—Of all the members of the body, next to the face, the hands have the most expression, and serve as an index of character and refinement.

Not only should the most scrupulous attention be given to having clean hands and nails, but every precaution should be taken to keep the skin soft and the nails carefully manicured. This is quite possible for the housewife, simply by wearing rubber gloves while she does her work. It preserves the fine sense of touch in the fingers, which aids in sewing and embroidery, at the same time that it adds much to the beauty of the hands.

Chapped Hands.—To prevent chapping of the hands in cold weather heavy gloves must be worn or a muff carried. Another aid in the prevention of the skin of the hands from becoming rough and chapped, and the best means for curing them if this has occurred, is by the use of a good cold cream at night, just before retiring. The cold cream should be well rubbed in the skin, especially about the finger-nails, and after this talcum powder be dusted over. This forms a thick covering for the hands, the talcum powder prevents the cream from being rubbed off on the bed-clothes, and, on getting up in the morning, the skin will be found to be soft. Only in case the hands are very badly chapped should old kid gloves be worn at night.

Cosmetic of the Nails.—The physiologic function of the nails is to protect the tips of the fingers against pressure and to give them a firm support; this increases the delicacy of the tactile sensations.

The nails should be slightly curved from side to side, of

a light rose color, and smooth surface. The lunula should be visible at the root of the nail. Brittleness of the nails is a defect, which causes them to tear easily; it is generally due to the condition of the general health.

There is a natural tendency for the dirt to accumulate on the under surface of the nail, between it and the finger. This is not only unsightly, but it is often the cause of actual danger, as this forms a lodgment for the germs of disease. Not only is it necessary for doctors and nurses to give the most scrupulous attention to the care of the nails, but, when we learn that one cook has been the cause of spreading typhoid fever through a number of families, in her itinerary in going from place to place, we must be impressed with the necessity of more careful oversight being given to the hands of domestics and housewives who prepare the food.

For the same reason, it is self-evident that the hands should always be washed immediately before going to the table, and cleaning the nails is always a finishing touch in the washing of the hands.

For the purpose of cleansing the nails, an orange stick or nail-file should be used, and never the point of the scissors or the blade of a knife, for either of these causes a roughening of the under surface of the nails, whereby the lodgment of dirt becomes only the more securely fixed. After the use of the nail-file, the nail-brush should be used, followed again by the use of the file or stick. If there is a tendency to a roughening of the skin under the nail, it can be obviated by the use of cold cream at night. Just before retiring, the fingers should be dipped into cold cream, and let the tips take up just as much as they will retain, and after this dipped into talcum powder.

The small rim of epidermis which laps over the nail should be gently shoved back with the orange stick every day. This skin, when torn, forms the so-called hang-nails, by which infection easily enters the system; it may give rise to felons or even to general blood-poisoning.

The Care of the Feet.—In the care of the feet it must be remembered that the leather of the closely fitting boot allows very little ventilation, and so more attention must be paid to the airing of the feet as well as to their bathing. The feet should be bathed twice daily.

On making the toilet for the evening dinner both shoes and stockings should be changed, the stockings hung up in the room, and the shoes left out to air and dry, instead of being stuffed into the shoe-bag, to remain there until the next morning.

An alcohol rub will be found very refreshing to weary feet. For profuse perspiration of the feet, boric acid or talcum powder may be used, dusting the powder over the feet both night and morning.

Ingrowing Toe-nails.—The common causes of ingrowing toe-nails are improper foot-wear and an improper method of cutting the nails. If the nail is cut too short, especially at the angles, while at the same time the shoe is too short or too narrow, the skin of the toe is forced over the nail, so that it necessarily happens that, by the further growth of the nail, the flesh of the toe is pushed still further over, until a point is reached where inflammation is set up. There is excruciating pain, which may be accompanied by the formation of a small tumor, which forms pus and may go on to granulation—the so-called "proud flesh."

The preventive measures of the trouble are, first, in cutting of the nails. The toe-nail should be cut in a concave form, the outer angle projecting beyond the toe. If there is a tendency for the flesh to grow over the nail, the flesh should be pushed back from the nail, and fastened in this position with a strip of oxid of zinc plaster, and a gauze packing should be inserted under the nail-edge. A saturated solution of boric acid serves as an antiseptic dressing. It is often possible to cut off the projecting nail, and, by the use of the boric acid dressing, the trouble disappears in a few days. Attention should always be given to the toe-nails when bathing.

Corns.—There are two varieties of corns; both are very

painful. Soft corns come between the toes, and unless absorbent cotton is inserted to prevent the rubbing of the toes together, a second corn appears on the opposing surface of the adjoining toe. A very effective remedy for this is the application of blue-stone, or sulphate of copper, to the corn. The stone is moistened in water and then applied thoroughly to the corn; absorbent cotton should be placed between the toes. In very severe cases it may be necessary to stay off the feet for a few days and keep the foot upon a chair.

Hard corns must be cut down with the greatest care. It should be done directly after the bath, so as to have the skin in as nearly an aseptic condition as possible. A small scalpel, composed entirely of steel, should be kept for this purpose. It must be thoroughly cleaned after it is used, and just before its use be sterilized by boiling for five minutes. The reasons for these precautions are the possibility of cutting into the flesh and setting up blood-poisoning by the entrance of germs into the wound.

CHAPTER IV

THE DIGESTIVE SYSTEM: GENERAL PRINCIPLES IN HUMAN NUTRITION AND DIETETICS

The Digestive Tract; Care of the Mouth and Teeth; Controlling Factors of Digestion; Psychic Aspect of Digestion; Importance of Mechanical Factors; Chemical Changes of Food in the Stomach; Intestinal Digestion; Metabolism; Constipation and its Treatment.

The Amount of Food Required; the Classification of Foods; Standard Dietaries; Maintenance Diet; Relations of Diet to Various Conditions of Life; Practical Facts for Guidance; Dietary in the Tropics; Food Economics; Table of Food Values.

The Physiologic Action of Moderate Doses of Alcohol; the Effect of Alcohol on the Muscular System; the Effect of Alcohol on the Nervous System.

"If there is anything new of importance in the practice of medicine it is this modern work in nutrition."—*Mendel*, 1914.

THE activities of animals are carried on by a certain expenditure of energy which is set free as the result of a chemical breaking down of the living tissues of the body. In order to maintain the equilibrium of the body this waste must be replaced by new material which is taken in the shape of food, drink, and oxygen.

Digestion is the term applied to those changes in the food-stuffs which precede absorption; it is a refining process which separates the useless from the useful, and further prepares the latter to be used as building-stones for the repair of organs and tissues and to furnish fuel to supply the motor energy of the body.

In the human body the digestive processes are brought about by mechanical disintegration; by the action on the food-stuffs of acid and alkaline fluids; by changes produced by active substances called enzymes; and, lastly, decomposition is produced by the growth of microörganisms.

The **digestive tract,** or alimentary canal, begins at the

mouth and ends at the anus. It consists of the mouth, the esophagus or gullet, the stomach, the small and large intestines. Two large glands, the liver and pancreas,

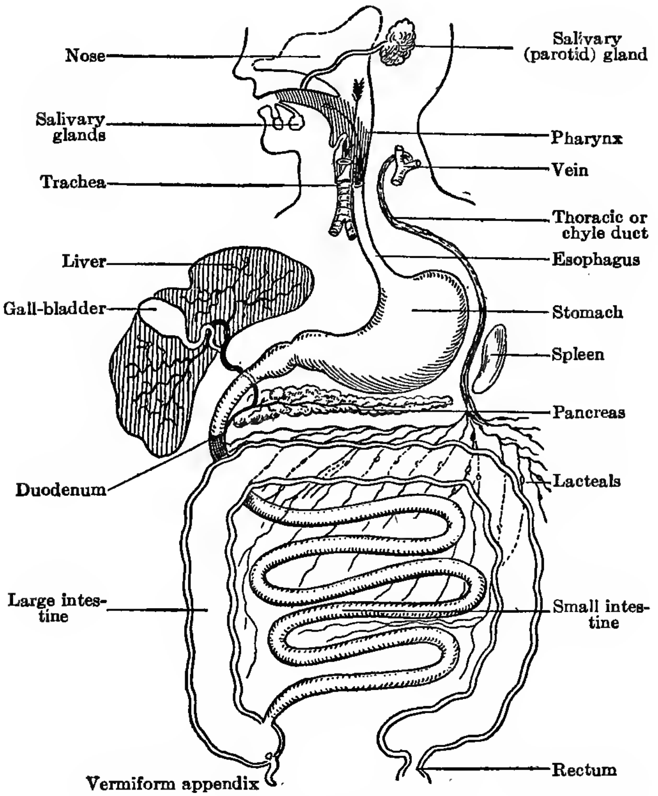


Fig. 4.—General scheme of the digestive tract, with the chief glands opening into it (Stockton).

pour their secretions into the small intestine to aid in the digestion of foods. The alimentary canal, liver, and pancreas together constitute the digestive system.

The contraction of the muscular walls of the digestive tract is the propelling power that carries the food downward and brings it into contact with the digestive fluids. These movements will be referred to later, under the Mechanics of Digestion.

The digestive tract is lined throughout its entire course by mucous membrane; that lining the mouth gives some idea of its character. It is from the mucous membrane lining the stomach and intestines, as well as from the liver and pancreas, that the digestive fluids are poured forth into its cavity.

In passing downward the food meets with five different digestive fluids: the saliva in the mouth; the gastric juice in the stomach; and the bile, pancreatic, and intestinal juices in the small intestine. Each digestive fluid acts only on some particular kinds of food. This action of the digestive fluids on food is called the chemical part of digestion.

The Care of the Mouth and Teeth.—It is of the first importance that the mouth should be kept clean and as nearly aseptic as possible, for as the food is rolled about in the mouth by the process of mastication it is obvious that it will carry all the germs and mucus with it into the stomach. A nasal spray containing some solution of an alkaline or antiseptic nature should form an essential part of the toilet of the mouth.

The Teeth.—From simply an esthetic point of view well-kept teeth are beautiful and greatly enhance the charm of the face. But the proper care of the teeth is also essential to good digestion and good health.

In perhaps the majority of people the teeth are sufficiently far apart for small particles of food to become lodged between them. If not promptly removed, the heat and moisture of the mouth, acting on these small particles, cause their decomposition and set up acid fermentation in the mouth; and it is this acid which causes the decay of the enamel and finally of the teeth. The decayed tooth gives still further lodgment to particles of food, and these, left

to decompose, give rise to the most offensive gases, giving fetor to the breath, poisons the blood, and so injures the digestive and nervous systems.

Where possible a tooth-pick and dental floss should be used immediately after each meal; the waxed dental floss between the teeth, and the flat end of the tooth-pick to remove any particles that may have worked in about the roots of the teeth and gums.

A tooth-brush with good tooth-powder should be used twice a day. The brush should not be too broad, and is better if slightly curved. The bristles should not be too hard. The use of tooth-powder, which must be very fine, or tooth-paste is needed to produce sufficient friction to clean the teeth well. Warm water is a better solvent than cold, and, therefore, it is well to use it for cleansing the teeth.

While it is generally known that decay if neglected will destroy a tooth, it is not so well known that many teeth are lost as the result of the accumulation of tartar at the gum margin. There is a great tendency to this, especially about the necks of the lower incisors and upon the teeth that are not used in chewing. The deposit of tartar encroaches upon the neck of the tooth and presses upon the gum; the latter becomes irritated or inflamed, and recedes from the tooth; malnutrition and loosening of the tooth follows.

With very imperfect or decayed teeth proper mastication is impossible.

The teeth should be examined by a good dentist twice a year, so that small cavities shall be discovered at an early stage, the tartar removed, and the teeth kept in their best condition. This will prevent the early loss of the teeth. Lost teeth must be replaced, so that the teeth shall be opposite each other, for a very important factor in mastication is that the teeth shall strike properly.

Digestion.—The factors controlling digestion are psychic, mechanical, and chemical.

Briefly stated, the process of digestion consists first in the liquefaction of the solid portions of food and the con-

version of the insoluble into soluble and diffusible, for no nutriment can be assimilated until reduced to a state in which it can pass through a cell membrane. These chemical changes are carried on by a series of enzymes.

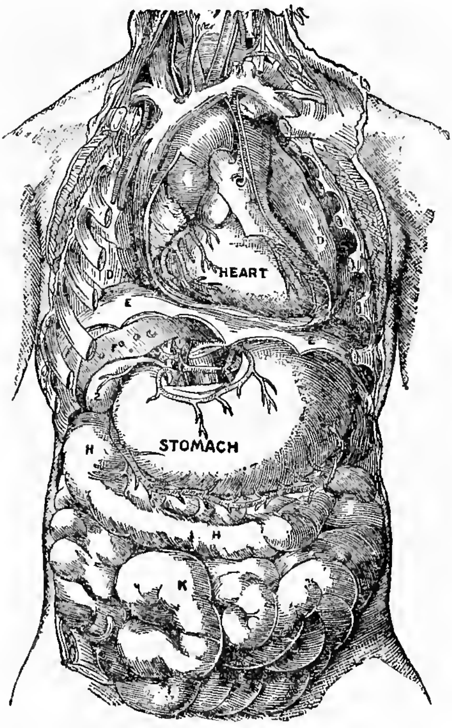


Fig. 5.—Location of the viscera of the body and their relation to each other: D, D, Lungs with air expelled; E, E, diaphragm cut away to show, F, liver cut to show stomach; 2, gall-bladder; H, H, large intestine; K, small intestine; L, vermiform appendix (after Heath).

Enzymes are unorganized ferments which possess the power of producing chemical changes in certain substances with which they come in contact under particular condi-

tions without themselves suffering permanent alteration. The digestion of food is largely accomplished by the specific action of these enzyme bodies, of which every digestive fluid contains one or more.

But neither solubility nor diffusibility is adequate. Freely soluble substances like cane-sugar need to undergo digestive changes just as definite as those carried out in the case of fats or coagulated proteins. The changes which they undergo before absorption serve a more fundamental purpose than the mere hastening of their passage through the lining membrane of the intestine.

In the light of modern chemical knowledge we can be somewhat specific in regard to the molecular aspects of the digestive processes. They are probably always *cleavages*, large molecules giving rise to smaller ones. When the original molecule is of extraordinary size, as with proteins and starches, these cleavages have a serial character, and a number of intermediary products must accordingly be formed; that is to say, the earlier products are in turn subjected to digestion. Such cleavages are generally, if not always, hydrolytic; that is, water enters into the reaction and its elements are found combined in the products.

The Psychic Aspect or the Effect of the Emotions on Digestion.—The relation of the emotions to the activities of the alimentary canal are of very practical importance, because recent investigations have shown that not only are the first stages of the digestive processes normally started by the pleasurable smell, sight, and taste of food, but also the pouring out of the gastric juice.

The importance of the initial psychic secretion of the saliva for further digestion is indicated when we realize that materials can be tasted only when dissolved in the mouth, and thereby brought into relation with the taste organs. The saliva which waters the mouth assures the dissolving of the dry but soluble food even when it is taken in large amounts.

The importance of the initial psychic secretion of gastric juice is made clear by the fact that the continued flow of

this juice during digestion not only stimulates the glands of the stomach to pour out the chemical gastric juice, but by its action on the mucous membrane of the duodenum it also starts the flow of bile and pancreatic juice.

These facts are of fundamental importance in the cooking and serving of food, especially when the appetite is fickle. A bright and cheery dining-room, the daintiness of the table service, the center-piece of ferns or flowers, all are factors in exciting the pleasurable emotions, and so stimulate the appetite.

On the other hand, the digestive processes may be wholly abolished by vexation, worry, and anxiety, or when such strong emotions as anger or fear are allowed to prevail. This fact has long been known in regard to the salivary secretion, and it has now been established in regard to the secretion of the gastric juice. It is necessary to avoid all circumstances likely to provoke emotional reactions.

The inhibitory influence of excitement on the flow of the gastric juice has been studied by Professor Cannon, of Harvard University, in an interesting series of experiments on dogs. And a most important point is that the cat, which was allowed to infuriate the dog being experimented on, was only in the room for five minutes, and in spite of the fact that the animal was hungry and ate eagerly; there was almost a complete suppression of the flow of gastric juice for a period of twenty minutes.

A similar experiment was tried on a boy with a gastric fistula. Food was shown to the boy and then withheld. He was so vexed because he could not eat at once that he began to cry and flew into a towering passion, with the result that no secretion appeared even after the child was calmed. In both the case of the dog and boy there was not only a temporary inhibition of the flow of gastric juice, but it is a noteworthy fact that the effects of the emotional excitement remained long after its cause had been removed.

The practical point is, that if the digestive processes have been inhibited by emotional disturbances any food

taken will lie stagnant in the stomach; and not only will there be a suppression of the gastric but of the pancreatic secretion as well, with the consequence that there is likely to be an accumulation of unabsorbed organic material in the colon and perhaps higher up as well. Bacterial decomposition will be fostered and actual harm may be done the organism.

And just as a single occasion may lead to a passing digestive disturbance, so continual mental depression, worry, or grief may permanently impair the working of the tract and so undermine the vigor and capacity of the sufferer.

It is believed that many acute attacks of indigestion in children are due to sharp rebukes administered at the table.

The Psychic Tone.—Just as there is a psychic secretion, so likewise there is a "psychic tone," or psychic contraction of the gastro-intestinal muscles, as a result of taking food. And just as the secretory activities of the stomach are inhibited by strong emotions, so also are the movements of the stomach. And, indeed, the movements of nearly the entire alimentary canal are almost completely stopped during moments of great excitement.

The condition of mental discord may thus give rise to a sense of gastric inertia, so that anxiety may be accompanied by a feeling of weight as if the food remained in the stomach, and every addition of food causes an increase of the distress.

The Importance of the Mechanical Factor in Digestion.—The mechanical reduction of food in the alimentary canal is preliminary to its actual digestion. The first stage of digestion takes place in the mouth, and this is the only portion of the digestive canal which is under the control of the will. It is here that the food is ground into fine particles by the act of mastication, and the more thoroughly the food is pulverized in the mouth, the more rapidly and easily can it be acted on by the gastric juice, and the very act of chewing increases the flow of saliva as well as shortens the time that the food will remain in the stomach.

The *saliva* not only protects the mucous membrane of the mouth, but it keeps it free from small food particles, which if allowed to remain would decompose, and thus injure the teeth by the action upon them by the acids produced.

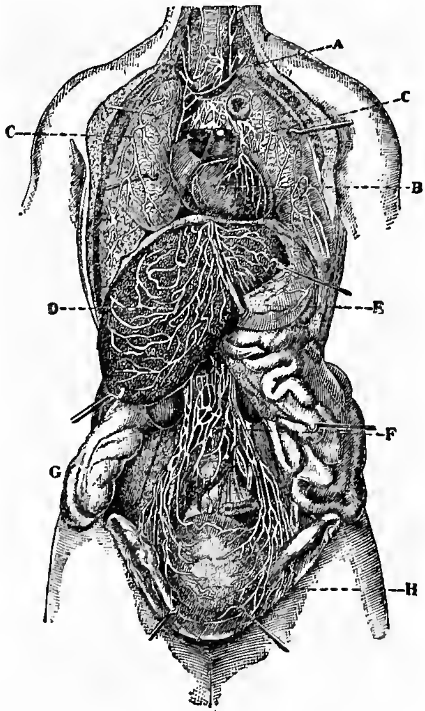


Fig. 6.—The ribs removed, showing relation of thoracic to abdominal viscera: A, Trachea; B, heart; C, C, lungs; D, liver; E, stomach; F, small intestine; G, large intestine; H, bladder (after Masse).

It also moistens the dry food, aids in the process of swallowing, and has some action on the starchy substances of the food. By the process of mastication, then, the food is divided into small particles and thoroughly admixed

with the saliva until the whole is converted into a fine pulp.

Besides favoring the mechanical part of digestion and its slight chemical action on starchy foods, saliva, being an alkaline fluid, is a distinct stimulation to the secretion of gastric juice. After the food has been reduced into a pulp in the mouth, and the change of starches into sugar has begun, it is swallowed and passes into the next compartment of the digestive apparatus, namely, the stomach.

The *stomach* may be felt at the lower extremity of the breast bone, in the triangular space formed by the divergence of the ribs. It is a large hollow, compound gland, the walls of which contain muscular fibers in addition to the tubules which elaborate the special secretions. Its cavity is lined with a thick mucous membrane, packed with tubular glands, into which is poured out a complex secretion called the gastric juice.

The Chemical Changes which Food Undergoes in the Stomach.—There are two chief phases or periods of gastric secretion: (*a*) The psychic or appetite juice, and (*b*) the chemical juice. Gastric juice is not constantly poured into the stomach to accumulate there, but is secreted only as it is needed under the influence of certain stimuli. These stimuli may be classified as psychic and chemical.

In the second phase, or period of gastric digestion, the exciting agent is the presence of food in the stomach. It has been shown that a correlation of the different organs of the body is brought about by *hormones* or chemical messengers. The hormones of gastric digestion are produced from proteins in the early stage of gastric digestion, and this shows the importance of the psychic or appetite juice. A similar effect is produced by meat extracts or infusions, which are well-known provocatives of gastric secretion.

Gastric Juice.—The principal active agents of the gastric juice are hydrochloric acid and the enzymes; pepsin, the proteolytic enzyme; rennin, the milk-curdling ferment; and lipase, the fat-splitting ferment. The uses of the gastric juice are digestive, activating, and disinfecting.

Gastric juice does not dissolve and chemically change all food that enters the stomach, but acts only on that class of foods called proteins, converting them into peptones.

The changes which food undergoes in the stomach are as follows: food is disintegrated; meat is broken up, gelatin dissolved; the muscle-fibers fall apart, and are split into disks and sarcous elements; the framework of fatty tissue undergoes similar dissolution of cellular membranes; milk is curdled; the caseinogen is transformed into casein, and the latter broken down by pepsin. Bread and other starchy foods are disintegrated, some of the starch being formed into sugar by ptyalin. The other vegetable foods are but little digested by this viscus. The whole is broken into irregular fragments by the disintegrating power of the stomach and gradually converted into *chyme*, the creamy emulsion which passes through the pylorus into the intestines. The passage from the stomach into the duodenum is aided by the motor activity of this organ.

The Mechanics of Digestion in the Stomach.—Recent investigations, especially those of Cannon, have thrown much light on this subject. The food introduced into the stomach from the esophagus is lodged first in the fundus or cardiac end of the stomach; from here it is moved by slow degrees toward the pylorus, from which it enters the small intestine. Formerly it was taught that this movement was brought about by a churning motion of the stomach throughout its entire length. Cannon has shown the error of this conclusion. From his observations it appears that the stomach is quiet at first. The waves of peristaltic constriction begin at the duodenal and middle portions and move the food toward the pylorus. In this way the constrictions that begin near the pyloric end gradually extend to the cardiac end. The latter part of the stomach is distended after a full meal, but gradually diminishes in size during digestion.

Moreover, there is a difference in the character of the gastric juice coming from the different areas of the stom-

ach; that from the middle portion being acid, and that from the cardiac and pyloric being neutral or nearly so. These facts show that the food remains for some time in the fundus and meets there a neutral liquid; consequently, the alkalinity of the mass is retained for a time, and the saliva acts upon the starch for a much longer period than has been supposed.

It is believed that the length of time which food remains in the stomach varies with its kind. The digesting mass is not forced into the intestine until it becomes well saturated with the free acid of the stomach, a result that will be reached later with a meat than with a vegetable diet; for it is plain that much more acid will be required to combine with the proteins of meat than with the smaller amounts in the carbohydrate foods, and so free acid is longer in accumulating.

Digestion is aided by the movements of the food mass through the contractions of the walls of the stomach, so that anything which lowers the tone of the stomach or impairs the integrity of its lining membrane seriously interferes with the digestive processes.

The nature of the food influences the rate of its passage through the pylorus. It has been shown by means of the x-rays that when the meal consisted of lean meat, suet, and rice, properly cooked and prepared in such a manner that the constituents were properly mixed together, the carbohydrates (rice) began to leave the stomach in fifteen minutes, but the protein (lean meat) and fat did not begin to leave it under one-half hour, and were much longer in passing through.

It was further found that in a normal stomach a meal of rice and potatoes gets out of the stomach rapidly, no trace being left in three hours, while a meal of protein and fat meat was much slower, some being present six hours after the meal. Indigestible substances are rejected by the sphincter and returned to the digestive cavity over and over again, but in the course of time the sphincter relaxes and the peristaltic contractions increase, until the force is

sufficient to drive through the opening hard substances like peas, plum-stones, and coins.

The Absorption of Food from the Stomach.—A very widespread misconception prevails in regard to the amount of absorption that takes place through the gastric walls. This is very limited indeed; some sugar, alcohol and other fluids, and a small proportion of nitrogenous matter are taken up, but that is all. The legitimate rôle of the stomach is a peptonizer and grinder only. Absorption of nutrients is the special work of the intestines, and occupies but a subordinate place in the duties of the stomach.

Proteins undergo peptonization, but that does not change them sufficiently. The mere splitting into peptones, formerly thought sufficient, is now known to be quite inadequate. Recent researches have shown that the complex protein molecule has to be quite crushed into a heterogeneous assemblage of fragments, from which those suitable for building up into the body protein are selected for that purpose, the remainder being used as fuel; that is, as a source of energy. In the case of the other food principles, fats and starches, the chemical processes are much simpler.

Intestinal Digestion.—The chemical changes which food undergoes in the small and large intestines are exceedingly complex. Digestion in the intestine is due to the combined action of the bile, pancreatic juice, and succus entericus. The material which enters the duodenum from the stomach is known as the chyme. The acid chyme provokes a flow of bile and pancreatic juice. It acts upon the *prosecretin* in the duodenal mucous membrane in such a manner that *secretin*, a hormone, is formed and carried by the blood to the cells of the pancreas which it stimulates.

Bile is a secretion of the cells of the liver and from the inner wall of the gall-bladder; after elaboration, bile is stored up in part at least in the gall-bladder. The secretion of bile is irregular in quantity, as is the case with the gastric juice, and appears to be induced by chemical excitants, of which acids, especially hydrochloric, seems to be especially effective. Of the nutrients, the proteins exert

the most influence. Less secretion follows the ingestion of carbohydrates than of proteins.

Formerly it was supposed that fatty foods checked the secretion of bile, but later experiments have proved that, to the contrary, they increase its secretion; and olive oil is a powerful cholagogue.

Bile precipitates the proteins of the chyme, neutralizes the acidity of the gastic juice, dissolving the fatty acids, and activates the lipase or steapsin of the pancreatic juice and assists in the absorption of fats. When for any reason the discharge of bile is retarded and the organism attempts to eliminate it through the kidneys, the tissues become charged with its compounds and take on a yellowish coloration.

Pancreatic Juice.—The second action upon the food in the intestine is that of the bicarbonate of soda contained in the pancreatic and intestinal juices, which neutralizes its acidity; and pancreatic digestion can only take place in an alkaline medium.

The pancreatic juice has the most comprehensive action of all of the digestive fluids; it contains a great variety of enzymes and acts upon all classes of nutrients. Its flow is intermittent, being induced by the action of the acids in the partially digested food from the stomach.

The pancreatic secretion attains its maximum pressure about three hours after a meal, but this varies according to the character of the meal. The enzymes of the pancreatic fluid are *trypsin, amylopsin, lipase* or *steapsin,* and *pancreatic rennin.*

Trypsin.—Pancreatic juice alone has but little influence on proteins, but when mixed with succus entericus its influence is great. Trypsin differs from pepsin by acting in an alkaline or neutral solution, and a free mineral acid, like hydrochloric, stops its operations; it acts much more powerfully and rapidly than pepsin. In conjunction with other enzymes it splits protein foods into simpler compounds, which may be regarded as the building stones of the original proteins.

Amylopsin.—The digestion of starch in the intestine is mainly effected by means of a diastatic ferment or enzyme in the pancreatic juice, called "amylopsin." This enzyme has the power of hydrolyzing the starch mostly into maltose.

Steapsin or Lipase.—The pancreatic secretion acts vigorously on fats, not only splitting them into fatty acids and glycerin, but, in conjunction with the bile, also effects their emulsification. This latter result is doubtless aided by the soaps which form a union of the fatty acids and alkaline bases (mostly sodium) in the bile. The cleavage of the fats is due to the enzyme steapsin.

The *succus entericus* is the secretion of the glands of Lieberkühn. It contains quite a number of enzymes, including four which act on carbohydrates, namely, *amylase, maltase, lactase,* and *invertase;* the proteolytic enzyme is *erepsin,* which seems to supplement the action of trypsin. It has no action on native proteins except casein, but it breaks down proteoses and peptones into *amino-acids.*

In other words, the discovery of erepsin in the succus entericus and its effects has led to the now almost generally accepted view that the digestion of the proteins is carried further than the stage of proteoses and peptones; in fact, that this enzyme hydrolyzes them into amino-acids, in which form they are taken up by the cells of the intestinal mucous membrane.

The Absorption of Food from the Intestines.—It was formerly believed that the main stream of the nutrient passed out of the intestines through the lacteals and thoracic duct into the circulation. But it is now known that only the fats take this course, and that the dissolved proteins, carbohydrates, some fats and salts find their way into the circulation through the portal system and the liver.

The blood contains a constant proportion of serum-albumin and serum-globulin, which are constructed out of the amino-acids resulting from the digestion of protein foods. The reconstruction of proteins takes place chiefly in the cells. Fuchs believes that the amino-acids from the food

are carried to all the tissues; and that the cells of the muscles and glands pick out from the blood the "building stones" necessary for the construction of their special proteins.

Fat is absorbed for the most part in the form of an emulsion and as a solution of soap. Only about 60 per cent. of the fat in the food is absorbed by the lacteals; the remaining 40 per cent. gets directly into the blood. The fat is carried directly by the blood-stream to the tissues all over the body; it is oxidized in the tissues to produce heat and energy; what is not immediately used for this purpose is stored up in the cells for future use.

Carbohydrates.—Practically all of the carbohydrates digested are absorbed in the form of sugar. The absorption takes place more rapidly in the upper than in the lower bowel. A portion of the ingested carbohydrates is destroyed in the alimentary canal by bacteria, whose enzymes transform them into various acids and gases.

The Absorption of Sugar.—The sugars pass into the blood through the portal circulation, and not through the lymphatic vessels. The question is, Where does sugar go after it gets into the blood? The proportion of sugar in the general circulation is not greater after a meal than before it. It is necessary that there should be some means of storing it, for it cannot all be immediately used for the production of energy. Is it stored as glycogen? Bunge believes that a considerable amount of carbohydrate is stored as fat, since the total amount of glycogen in the liver never exceeds 150 grams, and there is a similar store in the whole mass of muscles. It is evident, therefore, that only a small proportion of carbohydrates is laid down as glycogen, and we must assume that the greater part of it is converted into fat. That fat accumulates in the body on a purely carbohydrate diet is proved beyond a doubt, and the formation of fat from sugar is considered proved by experimental evidence.

Sugar is an important source of energy for the muscles, and provision is made for a sufficiency of it always to be in

the blood circulating through them, and the storehouse from which it is derived is the liver. When the liver and muscles contain enough glycogen to keep the blood supplied with it, the excess of sugar is converted into fat, and is reconverted into sugar when there is a demand for it.

Mechanics of Digestion in the Intestines.—The intestinal movements, like those of the stomach, have recently been studied by means of the *x*-rays. There are three kinds: A pendulum-like motion, consisting of a gentle, swaying, rhythmic movement occurring in all parts of the intestines. These movements do not affect the whole of the gut at one time, but occur in successive segments of it, and are more obvious in those parts which are distended with food, at a period of three or four hours after a meal. They are most energetic in the upper and least so in the lower part of the gut, and proceed from above downward with the course of the food.

The movement consists in lengthening and narrowing, followed by shortening and widening, of the canal; the contraction involves both the longitudinal and circular muscular coats, and in the course of its progress divides the bowel into many segments. This movement breaks up the food, sways it backward and forward, diffuses the digestive fluids through it, and drives chyle into the lacteals.

The second kind of movement consists of peristalsis, or wave-like propulsive movements; also localized dilatation, followed by contraction of the canal, progressing from above downward at the rate of 1 or 2 inches per second, and is from three to four hours traveling the entire length of the intestines.

Under pathologic conditions a third movement is observed, consisting of a swift venicular movement, starting at the pylorus and traveling the entire length of the gut in about one minute. It is produced by toxins, gases, and other irritants.

Digestion is practically completed in the small intestine.

The *colon* consists of a proximal portion, consisting of the

cecum, ascending colon, and one-half of the transverse colon; a mesial part, formed by the other half of the transverse colon and part of the descending colon and a distal portion, formed by the remainder of the descending colon and of the rectum. The contents of the proximal portion are fluid; food accumulates in this portion; it is gradually concentrated by the absorption of water. It has been shown by the x-rays that a meal reaches the cecum in four or five hours; the hepatic flexure in six or seven hours; the splenic flexure in nine hours; and the rectum in about eighteen hours.

The feces consist of the residue of the food, digestive secretions, etc. The contents of the alimentary canal become altered in character as they descend its course. The mass attains a greater density as it descends, more and more nutrient being absorbed from it, and even in the colon it becomes more solid; its color is brownish and its odor characteristic. The amount of feces from an average mixed diet represents from one-seventh to one-eighth of the food consumed.

Defecation.—The waste matter which collects in the lower bowel must be evacuated every day. Allowed to remain longer than this, the digestive system is clogged by the non-removal of worn-out material, and the blood is constantly absorbing matter which is poisonous to the body. Decomposition goes on without being suspected by the sufferer.

Intestinal bacteria or *organized ferments* are present throughout the entire intestinal canal and play a part in the food changes. They are most abundant in the lower part of the small intestine and the upper part of the large. They act upon the proteins, causing putrefaction, dissolve cellulose, and cause a decomposition of the carbohydrates. The products of these fermentations include indol and skatol, which have the characteristic fecal odor; volatile fatty acids and gases, some of which are carbon dioxid, hydrogen, marsh-gas, and hydrogen sulphid.

Fermentations of this character up to a certain extent

are normal and may be beneficial, but they may proceed so far as to be deleterious to health. Anything which retards digestion, such as imperfect mastication, excessive eating, abnormal amounts of meat in the diet, and failure of the organs secreting the digestive fluids to supply these secretions in sufficient quantity, gives these bacteria a better opportunity to act on the food residues and so increases their bad effects.

Some foods, especially vegetables of the leguminous class, appear to be provocative of excessive intestinal fermentation. Flatulence and even toxic poisoning may be the result of great bacterial activity in the digestive tract. It is hardly possible to check this by administering septics, but purging is of value by removing the fermentative material. Particular foods, especially soured milk and kephir, have been shown to have a preventive action on putrefaction.

Influence of Food on Secretion.—The more recent investigations reveal the fact that the kind of food has an influence not only on the abundance, but also on the kind of digestive secretions; this is most important because an abundant supply of digestive juices is necessary for good digestion. Broths, meat extracts, and milk stimulate the secretion of the gastric juice, which makes rational the taking of soup or bouillon as the first course at dinner, or the eating of toast or zwieback by persons with weak digestions. Fats, on the other hand, tend to inhibit gastric secretion, so that an excessive proportion of fat in the meat might hinder digestion in the stomach.

Food may exert an indirect influence on the pancreatic secretion. The acid in the chyme stimulates the flow of pancreatic juice. One is almost inclined to speak of the physiologic education of the digestive glands, and to conceive them as being trained for fat, protein, or carbohydrate digestion.

Metabolism.—Life consists, so far as material phenomena are concerned, in the transformation of matter into energy. To these transformations the term *metabolism* is

applied. In the metabolism of matter the changes are chemical; in energy the changes are physical. It is commonly assumed that the laws of conservation of matter and energy are conformed to or obeyed in animal bodies.

The body converts potential into kinetic energy by metabolism in the body. The potential energy of food is transformed into the actual energy of heat and mechanical labor. In this respect the only difference beteen man and other vertebrates is the nervous and intellectual processes, which are not yet understood.

Metabolism is anabolic and katabolic. *Anabolism* is constructive; it includes growth and the act of the tissues in selecting, appropriating, and making substances absorbed from the alimentary canal a part of themselves. The body is never stable; while growth and nutrition progress, destruction or demolition takes place, and this is called *katabolism.* To ascertain the exact amount of matter and energy used daily by the body a balance sheet of the exchange of material is necessary. The *income* consists of (*a*) matter—food, drink, and the oxygen of the air; (*b*) *energy*, the potential energy of the food and drink. The *outgo* consists of (*a*) matter in the feces, urine, perspiration, and breath; (*b*) energy—the potential energy of feces, urine, products of respiration, and perspiration. A complete account would show the amount of C, N, H, O, P, S, Cl, Na, Ca, K, Mg, and Fe in the income and outgo, it would also show the compounds in the excreta, including proteins, carbohydrates, water, and carbonic acid.

Experiments show that the body requires a given quantity of given energy producing substances for sustenance, and something more to meet the demands for muscular work.

The metabolism of nitrogen is usually measured by the amount of urea in the urine, taking into account the small proportion of uric acid and other nitrogenous bodies. In fasting the organism lives on its own flesh and fat.

The Effects of a Nitrogenous Diet on Metabolism.—The most striking effect of a purely nitrogenous diet is a large

increase in the nitrogenous metabolism, but it also increases the metabolism of the non-nitrogenous elements of the body. With an ordinary mixed diet the normal excretion of urea varies from 33 to 37 grams a day, while with a meat diet the urea may rise to 50 or even 80 grams daily.

Carbohydrates as a Protein Protector.—It has long been observed that when there was a deficiency of protein in the food the metabolism of nitrogen will be spared and the tissues protected if the food contains plenty of carbohydrates and fat. The subject was fully investigated by Lusk. When the diet contains an abundance of protein, carbohydrates, and fat the organism gains a little nitrogen; when the diet contains the same amount of protein but no carbohydrates, the body loses considerable nitrogen. Again, when the food was the ordinary mixed kind, and contained a sufficiency of energy, but was of a low protein character, the excretion of nitrogen was normal. These results led to the conclusion that the carbohydrates were a protein protector.

Fat as a Protector of Proteins.—The metabolism of nitrogenous tissue and elimination of nitrogen is not prevented by the consumption of fat, but the consumption of fat reduces the metabolism of protein so much that one-quarter or one-third as much meat will suffice to maintain the nitrogen equilibrium as would have to be consumed if only lean meat was used.

The nutritive value of meat extracts is comparatively small; their chief value is in promoting digestion and metabolism of other foods.

Water and Metabolism.—The body consists of 530 parts of water per 1000. It is of greatest importance as a component of the tissues to assist in the exchange of nutritive substances, the discharge of the products of metabolism, the regulation of temperature, and other vital functions. If the supply of water is stopped the body will die, and it may die sooner from the deprivation of water than from starvation.

A reduction in the amount of water consumed accelerates the decomposition of protein and fat to replace the water essential for the bodily functions. As the result of experiments it has been found that the average income of water is 4 pints, and the excretion is $4\frac{1}{2}$ pints; so that at the lowest estimate $\frac{1}{2}$ pint of water is formed in the tissues by the oxidation of hydrogen in the food and tissues; and during ordinary work it was found that 17 ounces of water was excreted daily in excess of that consumed in food and drink.

The intense suffering entailed by prolonged thirst is to be accounted for by the absolute necessity for preserving the normal aqueous dilution throughout the body.

Water is also essential for removing the effete materials arising from metabolism, cell growth, and other disintegration.

Chlorids.—About 15 to 18 grams of sodium chlorid (common salt) are excreted daily in the urine, and smaller quantities in the feces and perspiration. It is, therefore, a most important food. The tissues retain common salt most tenaciously, and when there is none in the food it gradually disappears from the urine. It facilitates the absorption of the protein foods and increases tissue metabolism. And, further, an insufficiency of common salt is followed by a diminution of hydrochloric acid from the gastric juice, and consequently a failure of nutrition. There can be no doubt that the hydrochloric acid of the gastric juice originates from the chlorids of the blood.

On the other hand, a very large number of people consume more salt than they require. Salt is not only a food, it is a condiment, and as such it is liable to abuse. It has been estimated that from 2 to 4 grams of salt a day is sufficient, whereas most people take from 20 to 30 grams daily in one way or another. The kidneys have to excrete the excess of salt, which they seem to do in health without any difficulty; but in nephritis the kidneys do not excrete it so readily, and this may lead to a retention of salt in the body.

Iron is essential to the human body. It is taken into the body in the form of food, and is excreted from the body in the bile and feces. It has been estimated that typical food contains 10 mgm. of iron daily. The hemoglobin of the blood contains 0.04 per cent. of iron.

Constipation.—It must be remembered that the intestine is a permanent source of poisons, which, under certain conditions, cause grave alterations in the principal organs, notably in the liver, kidneys, and skin, and serious functional disturbances of the nervous system.

Normally, the organism manages to protect itself against the microörganisms which are found in the intestines; given, however, certain conditions, the toxic products can be generated in excess of the powers of the organism to dispose of them, such as errors of diet, quantitative or qualitative, atony of the muscular walls of the intestine, and, above all, constipation. The higher up in the intestine the stasis occurs, the more serious is the result. Constipation is considered by many surgeons as the most important factor in the production of appendicitis.

There is frequently a condition present which is known as semiconstipation, and which is most deceptive to the patient. There may be a bowel movement every day, but the bowel is never emptied; only the lower portion of the hardened fecal matter is broken off. This is repeatedly found to be the case in examining women for some form of pelvic trouble, and in a woman who says that she has a daily evacuation of the bowels, and has had one that very morning, the sigmoid flexure will be found to be packed with hardened feces.

Besides the clogging up of the digestive system by the non-removal of the waste-products of digestion, the formation of hemorrhoids, which is caused by the mechanical pressure on the veins, and so interferes with their emptying out in the normal way, and the general auto-intoxication of the entire system, there are also caused in women serious displacements of the pelvic organs together with their congestion and inflammation.

The general symptoms of autointoxication are: headache, vertigo, palpitation of the heart, a feeble and irregular pulse, irritability of temper, melancholia, numbness and tingling in the hands and feet, and the emaciation and loss of weight are sometimes so marked as to lead to the suspicion of malignant disease.

Treatment of Constipation.—This should always be preventive, and the diet is a most important factor. The food should be of a coarse quality, that is, such as directly stimulates the walls of the intestine to contraction by their constitutents, or by the large amount of the indigestible bulk. Corn and Graham bread should be substituted for white bread. Toast is always constipating. Plenty of fresh fruit and vegetables should be eaten. For those who can digest them, raw apples, eaten just before retiring, are a great aid. The drinking of a sufficient quantity of water daily is also essential, and this quantity must be 3 pints. A glassful of cold water, taken the first thing in the morning on rising, is often very effective. If this is insufficient, the phosphate of soda, one teaspoonful to one tablespoonful, may be added.

Habit.—Nowhere is the effect of habit more conspicuous than in the matter of a daily evacuation of the bowels. There should be a fixed time every day for this, and the very best time is in the morning, directly after breakfast. Such a habit, once established, will enforce itself upon the attention and make regularity a necessity. It not infrequently happens that constipation is the result of irregularity in going to the toilet. The school-girl or woman gets up a little late, and, although she may feel the inclination to empty the bowels, she is able to defer it.

If the movement is sufficiently large, one stool daily is sufficient, but where the stool is slight in quantity, there may be two or three during the day, entirely consistent with health, and in a run down state of the system there are apt to be several small movements rather than one full stool. So long as the stools are not watery, the individual may rest assured that there is no looseness of the bowels.

Constipation should never be allowed to become chronic. It is, as has already been shown, the progenitor of myriads of the most serious diseases; and, after the bad habits of years have been established, it is one of the most obstinate of diseases to cure. In every case a good physician should be consulted at once, and the treatment should be persevered in until the cure is complete. It is a well-known fact that all medicines for this trouble lose their effect, the dose has to be increased, and a frequent change made from one laxative to another. When everything else fails, electricity may be resorted to. It is one of our most valuable remedies, since it brings about a cure through the toning up of the muscular walls of the intestine.

The constant use of hot clysters to empty the rectum is one of the most pernicious habits; in this manner the bowel becomes overdistended and loses its tone, and the fecal mass is not sufficiently large to cause the distention of the rectum, which is the normal stimulus leading to the desire to defecate.

The Amount of Food Required.—Food is required for growth and for repair; that is, to build up the organism and make good the loses sustained by physiologic processes, to maintain the heat of the organism, and to supply it with mechanical energy.

It has become an established custom to compare the human body to a machine. Both derive their power from fuel; in both instances the potential energy of the fuel is transformed into kinetic energy or mechanical power which works the machine; in both cases the energy which is not used in work escapes in the form of heat.

The human body uses the mechanical power chiefly in muscular work; the heat is used in warming the body and causing the evaporation of moisture from its surface. The animal organism is much superior to the mechanical engine. It is more economic in the use of fuel; it has a nervous organization rendering it sensible to impressions and capable of directing its energies. The human machine is

capable of adapting itself to many circumstances and changes in the demands upon it.

But to enable the body to continue to perform these functions indefinitely it must be properly fed, and a proper feeding of the body requires a knowledge of its composition and the exchanges which are constantly going on. This knowledge is to be derived from a study of its metabolism, the analysis of foods, and a determination of their heat values.

The Classification of Foods.—Foods are divided into proteins, carbohydrates, fats, mineral salts, and water. The body is composed of materials belonging to the same groups. Proteins form the principal part of muscles, bones, and many other tissues of animal bodies; they also constitute some of the most important vegetable structures.

Proteins are probably the most complex compounds in nature; all contain carbon, hydrogen, oxygen, and nitrogen, generally sulphur, and sometimes phosphorus also. They are, with rare exceptions, colloids, that is, glue-like, non-crystalline bodies, which even in solution cannot pass through animal membranes.

The building stones of the body are the amino-acids. All proteins contain them, but the kinds and proportions are not always the same. It has been shown by biologic experiments that life and growth cannot be maintained when certain amino-acids are deficient.

Proteins are of use to the human body as tissue formers, and, secondly, as producers of energy, but they also have a food value as flavoring agents, rendering the food appetizing, and so are to a certain extent stimulants. The palatability of meats and soups are due to their presence. The amino-acids have decided heat value.

The necessity for proteins in the diet has been abundantly demonstrated. Many investigations have shown that when the food contains no protein the waste of nitrogen continues, no matter how abundant the supply of carbohydrates and fats. In other words, a continuous protein cleavage is demanded by the animal organism, and no other nutriments can serve as a substitute for protein to

meet this demand. If the food contains no protein, the body tissues will be depleted. It cannot be said that carbohydrates or fats are an essential part of the diet in the sense that protein is, because it is possible to substitute one for the other to produce energy, or to substitute proteins for both.

In spite of these facts, it is safe to assert that the welfare of the human organism is best promoted by a mixed diet, including all three classes of food. The larger part of man's food is used for the production of energy, and it is physiologically economic that this energy be supplied by the non-nitrogenous nutrients, particularly the carbohydrates, and to allocate to protein, so far as practicable, its special rôle of building material.

Nitrogenous Waste Products.—The end-product of proteins is urea, which is formed from protein decomposition products in relatively large amounts in the liver cells, and, being readily soluble and diffusible, is easily eliminated by the kidneys. Besides urea there are other smaller quantities of nitrogen compounds, the one most deserving of notice being uric acid.

When the proteins are broken down to supply energy, there is always a definite proportion of urea and uric acid residue that must be eliminated through the kidneys. An excessive protein diet would burden these organs beyond their accustomed habit, and flooding the system with these nitrogenous wastes increases the tendency to rheumatism and gout.

Uric acid is of general interest, and when present in the system in abnormally large amounts, as in gouty persons, has a pathologic significance. It is more complex in its composition, and, what is of particular importance, is that it does not readily dissolve. It forms very insoluble salts which have unpleasant tendencies to settle in the joints, causing great pain. Did its metabolism proceed properly, it should be resolved into urea and carbon dioxid. The quantity of uric acid that appears in the urine is the residue that has escaped this oxidation.

Uric acid is built up from purin bodies in the food, so that it would be well for those with a gouty diathesis to abstain, at least when an attack of gout threatens, from all aliment in which purin is at all abundant. The most valuable of the purin-free foods are eggs and milk, and to these the uric-acid sufferer has to turn in times of trouble.

Carbohydrates Physiologically Economic.—This group of compounds comprises starches, sugars, and gums; the elements of which they are composed—namely, carbon, hydrogen, and oxygen—are so balanced that if all of the carbon were removed the residual hydrogen and oxygen would be in the proportions to form water.

Carbohydrates are usually characterized as the fuel portions of the food, or, in other words, that part which is burned to produce the various forms of energy. They are also essential for the well-being of the organism; reduction of the intake below the essential point frequently leads to acetonuria.

When the metabolism is perfect, any carbohydrates consumed in excess of the ordinary requirements are converted into glycogen and fat and stored for providing fuel at a future date. When stored as fats they are completely oxidized in the simplest compounds, carbon dioxid and water, and are eliminated through the lungs and skin, possibly part of the water so formed acting as a solvent for the urinary compounds. Investigations seem to prove that the body has a preference for the carbohydrates over fats or other nutrients as a source of energy. There is every justification for the abundance of starches in man's diet.

Fat is essential in the food of mankind; it is absorbed ready formed from the food, or manufactured in the body from the proteins and carbohydrates. Neutral fats and fatty acids are valuable foods; their primary function is to supply the body with fuel for heat and energy.

The *mineral substances* form 5 or 6 per cent. by weight of the human body, and are constantly leaving it by different channels; they are indispensable elements of food. They give solidity and stability to the organism, constituting a

considerable proportion of the bones. They keep various proteins in solution and confer upon them the property of electric conductivity. They are necessary for all of the secretions and assist in the general metabolism. The carbonates of soda, potash, iron, and other minerals render the blood and secretions alkaline. The removal of carbon dioxid is performed mainly by the alkaline carbonates, which take it from the blood and surrender it to the lungs. We have already considered the need of sodium chlorid. The total daily requirements of salts is estimated at about 360 grains.

Vitamins a New Factor in Nutrition.—But recent investigation has proved that something more is essential for the maintenance of growth and well-being than protein, carbohydrates, fats, and salts; that food contains a minute portion of accessory bodies, and that when they are deficient or absent from the diet the immature body does not grow, the mature body does not maintain its condition, and there are manifestations of more or less serious disease. These accessory bodies have been called "vitamins," and they are essential to maintain the normal metabolism of the body.

It is recognized that although vitamins are undoubtedly widely distributed in food products, they occur for the most part in very minute amounts, and the various foods differ in the proportion which they contain. If the diet is made up of substances which are poor in vitamins, or rendered so by their mode of preparation, abnormal metabolic processes have been found to follow.

The study by many scientists during the past few years of the enzymes and their striking specificity; of the salts; of the insufficiency of many proteins, and of the vitamins is epoch making, and has caused a corresponding advance in dietetics. These discoveries are so important as to raise the question whether nutritive failure or success does not depend as much on the accessory bodies—the vitamins, the enzymes, and lipoids—as on the primary element of the diet.

In addition to these food principles, there exists in our food a number of compounds which, while not indispensable, act beneficially as flavorings, stimulants to digestion, etc.; these are termed food adjuncts, and comprise such bases as caffein, essential oils, organic acids, etc.

Standard Dietaries: The Maintenance Diet.—There is great need of *standardization* and of knowledge regarding the maintenance diet, first among physicians and then among the people in general, or scientific dietaries based on the nutritive value of foods. These are given in terms of proteins, carbohydrates, and fats, together with the aggregate energy of the nutritive value in each. This is the corner-stone of dietetics.

Dietetics is the science of feeding. It has to do with the necessities of the body and the ability of the food to meet these necessities in the various circumstances and conditions of life. The ultimate scientific knowledge concerning human nutrition should be to promote the healthful and economic use of food.

The problems to be dealt with are quite complex. These are: (1) changes in the economic conditions of the population; (2) changes in food production and food supply; (3) changes in the methods of preparing food.

In regard to the influence of the economic conditions of the people on the composition of their diet, it might be expected that a considerable decrease in the earning capacity of the poorer people, or an increase in the cost of foods, would be followed by a change in their diet. Everyday experience teaches that under such conditions the more expensive foods—meat, eggs, and milk—are reduced in the diet. These same foods are also rich in vitamins, so that a reduction here would, therefore, reduce the vitamin content of the dietary unless other dietary complements rich in vitamins, such as legumes, were introduced.

The value of any food as a source of heat and energy is measured by a bomb-calorimeter. The heat given off during the combustion is a measure of the latent or potential energy of the food. The kinetic energy of the food is

the amount of heat developed by the proportion which is digested. The unit commonly used is the calorie, or the amount of heat which would be required to raise the temperature of 1 kilogram of water 1° C., which is about equal to that required to raise the temperature of 1 pound of water 4° F.

Heat Value and Digestibility of Foods.—One of the chief functions of food is to supply the body with heat and energy; the food must be capable of digestion and absorption. Herein lies the exact value of any food to the consumer. In science the figures that are given for the digestibility of the various foods refer to the completeness or extent to which the food is dissolved and transferred to the circulation, and an indigestible one is that of which a considerable portion passes out of the system into the feces without being disintegrated and absorbed.

Animal food is more completely digested than vegetable food, as shown by the difference of nitrogen in the feces. In meats 97 per cent. of the protein and 98 per cent. of the fat are absorbed. Lean meat is more rapidly digested than fat, and the flesh of young animals than that of older ones.

The breast of chicken, fresh beef, and mutton are among the most digestible of the solid foods. Raw and rare meats are more easily digested than well-done meats; in other words, cooking lessens the digestibility of meats. Steak should be broiled and never fried; all fried foods are difficult to digest. Veal and pork are both difficult to digest.

Eggs are almost as nutritious as meat; their digestibility is unsurpassed and only equalled by a few foods, such as milk and oysters. They are most easily digested when soft boiled or poached. Dry toast finely broken up and mixed with a soft-boiled egg aids in its digestion. Soft-boiled eggs are more easily digested than raw eggs, but the latter are less irritating to the stomach, probably because they are digested in the intestines. It has been found that two poached or soft-boiled eggs leave the stomach in from two to three hours; that is, in the same time as milk, oysters, white bread, and light fish.

Milk.—Although one of the most completely digested of foods in a mixed diet, milk is not quite so completely digested as meat and eggs. When milk is the sole food (milk diet) the proportion digested depends partly on the amount consumed. With the consumption of $3\frac{1}{2}$ pints of milk daily the loss of milk solids varies from 10 to 11.16 per cent. Young children digest milk more completely than adults.

The addition of aërated waters or crackers broken up in the milk prevent the formation of tough clots, and hence render it more digestible. Hot (not boiled) milk is more digestible than cold. Boiling increases the toughness of the curd, but it destroys the bacteria. Buttermilk and koumiss are more easily digested than cows' milk.

Wheat flour enters largely into the diet of every family. In producing it the outer coating of the wheat kernel is removed, thus throwing into the milling offals that part of the kernel which is most heavily charged with mineral ingredients and vitamins. The proportion of digestible proteins in white flour is not less than in whole wheat flour, as is so often claimed, but because the latter is richer in mineral ingredients its use is recommended.

Bread is readily digestible; white bread digests more rapidly than brown or black; and crackers more rapidly than either.

Rice is another cereal of great economic importance. As a food for invalids it possesses a high value on account of its digestibility, especially in intestinal diseases. Ordinarily polished rice contains only 0.5 per cent. of cellulose, and almost all of the substance of the grain is absorbed.

There is a perfect analogy between the well-known relation of the polishing of rice to its nutritive value, and the milling of wheat and corn to the nutritive value of wheat, flour, and cornmeal; that is, it loses the mineral ingredients and vitamins.

Potatoes.—In European countries potatoes rank next to bread; this arises from the ease of their digestion. From

92 to 95 per cent. of the starch is absorbed, but there is a loss of 23 per cent. of the protein.

The manner of preparation of vegetable foods determines the proportion of loss. When potatoes are baked or boiled in the skins the loss is negligible. The greatest amount of loss occurs when the skins are removed, the potatoes then allowed to soak in cold water, and placed in cold water to boil. The potatoes should be pared just before cooking, and the water should be boiling hard before they are put in. Mealy potatoes digest more rapidly than waxy ones, and mashed quicker than unmashed.

Oatmeal, barley meal, and other cereals which are not ground very fine do not digest so easily as wheat flour, but much depends on the mode of cooking. When oatmeal-gruel is consumed with a sufficient amount of milk it forms a complete diet.

Nuts are valuable as a source of protein and fat, but they are rather difficult of digestion.

Fats.—As a rule, children do not thrive whose diet is deficient in fats, and even adults are prone to tuberculosis and nervous diseases when fat in the body is deficient.

Cheese is one of the most indigestible of foods. All fried foods are highly indigestible because the fat envelope of the foods has to be melted off before the gastric juice can act on the food substance itself. Pastry is also very indigestible. Of the vegetables, beans, while highly nutritious, are exceedingly difficult of digestion; also boiled cabbage, cauliflower, hot breads, iced drinks, ice-cream, and water-ices.

The Relation of Diet to Various Conditions of Life.—The chief factors influencing bodily needs are age, height, weight, occupation, idisoyncrasies, and atmospheric conditions.

All activity of the human body, whether in the maintenance of its functions or in the performance of labor, is work. These two forms of work may be classified as physiologic and mechanical. Nothing in nutrition is more important than the relation of food to work.

Children are practically in constant motion during their waking hours, and their demand for food energy is from two to three times as much per unit of weight as that for adults.

Sex.—Men and women of the same age and weight, doing the same kind and amount of work, require the same amount of food. The fact that men usually require more food than women is because, as a rule, they weigh more, are more active physically, and perform more external work.

Temperament.—Persons of a nervous type, being more active, use more energy than the phlegmatic, and, therefore, require more food.

Brain Workers.—A man whose work is sedentary and chiefly mental does not need so much food as a man doing muscular work. The amount of carbohydrates required is less, and the amount of fat rather more than for the man doing light muscular work.

Ranke's diet for the brain worker is: Protein, 100 grams; fats, 100 grams; carbohydrates, 240 grams; giving an energy value of 2310 calories.

The diet should not be bulky, but light and easily digestible. Excess of food and heavy foods are especially bad for brain workers because they produce heaviness, dulness, and drowsiness. Spiced and rich foods upset the alimentary functions, whereby the circulation is flooded with the products of imperfect metabolism to the detriment of the brain.

Trained workmen will do a given amount of labor on less food than untrained, because when persons take up mechanical operations with which they are unfamiliar, or undertake work which exercises a new set of muscles, a unit of work accomplished costs more in food energy than when the muscles have been trained to do a particular thing.

Very strenuous exercise, like athletic contests and unnaturally slow movements, are both wasteful of food energy.

Again, a continuance of the same labor for hours, and a state of fatigue, whether it comes after a longer or shorter

time, causes an increase in the energy expenditure per unit of work performed.

Economy in the use of energy that food supplies to the body is most fully secured when the movements of the body are at the natural rate; when periods of intense effort do not occur, and when the labor is not too long continued and is not carried to the point of fatigue.

Standard for Daily Dietaries (American)—Atwater.

	Protein. Grams.	Fuel value. Calories.	Nutritive ratio.
Woman with light muscular exercise	90	2400	5.5
Woman with moderate muscular work; Man without muscular work	100	2700	5.6
Man with light muscular work	112	3000	5.5
Man with moderate muscular work	125	3500	5.8
Man with hard muscular work	150	4500	6.3

The Relation of Food Economics to Social Welfare.—A virile nation is one whose citizens are of a good physical type, which means that they are well nourished. A well-fed people, other conditions being favorable, is a strong people. Food is the physical basis not only of the individual activity, but also of social energy. Any causes, therefore, which limit the food supply or increase the burden of securing adequate nourishment strike a blow at the nation's vital power.

We must constantly keep in mind that the energy output is practically the energy requirement, under given conditions, of course; and the expenditure caused by the muscular activity of a particular individual cannot be reduced without affecting the work done or causing the loss of body substance.

Investigation has shown that there is a necessary daily protein minimum use. When insufficient protein is taken in the food, the necessary balance will be supplied by drawing on the tissues of the body. The food standards which are based on the observation of practice call for not less than 100 grams of protein daily for professional men and 175 grams for men at severe labor.

It is held to be significant that communities holding leading positions in the world consume a liberal amount of protein, or, conversely, that communities with an inferior physical and mental status use a low proportion of proteins in the diet. Again, if we argue from the analogies in feeding farm animals, generous protein feeding is desirable for the growth and maintenance of vigorous organisms and a satisfactory rate of production.

On the other hand, the well-known experience of the ages has shown that the poor who live on a low protein diet are the most liable to disease. It cannot be gainsaid that the meat eater has greater stamina and energy than the one whose diet is poor in protein.

The conclusion is, that while a minimum of protein is essential to the organism, a greater proportion is advantageous by acting as a stimulant to the metabolism and as a ready source of energy; that people are better for the consumption of proteins in quantities greater than in Chittenden's standard, and possess greater resistance to disease, probably because the body is stimulated to manufacture antibodies.

Practical Facts for Guidance.—The housewife who keeps the following facts in mind may combine foods in an approximate way that will fully meet the demands of the human organism.

The proper ratio is 1 part of protein to 5 parts of non-protein; and the fat should equal one-half of the weight of the protein. This gives the following normal dietary:

	Weight. Grams.	Weight. Ounces.	Energy supplied. Calories.
Protein	100	$3\frac{1}{2}$	410
Carbohydrates	400	$14\frac{1}{2}$	1640
Fats	50	$1\frac{3}{4}$	465
			2515

Proportion of Proteins in Foods.—*Foods Rich in Proteins.*—Lean meat, dried peas, beans, and lentils, 18 to 25

per cent.; fat meat, 12 to 18 per cent.; eggs, 12 per cent.; oatmeal, 10 to 15 per cent.; cheese, 25 to 35 per cent.

Foods with Moderate Amounts of Proteins.—Milk averages 3½ per cent.; fresh peas, beans, and lentils, 3 to 8 per cent.; white bread, 6 to 7 per cent.; fine wheat flour and barley, 8 to 10 or 12 per cent.

Food with Usually Less than 3 Per Cent. of Proteins.—Green vegetables, potatoes, and roots, such as carrots, turnips, and onions, etc.

Legumes and certain nuts supply relatively more protein than other vegetable foods, so that when the cost of meat, fowl, fish, eggs, or milk is prohibitive, the freer use of beans, peas, lentils, and nuts is strongly recommended.

The unmodified foods, such as grain, vegetables, fruit, meat, eggs, and milk, may be depended upon to amply supply all the necessary elements to sustain growth, functions, and waste of the human body. On the other hand, foods which it is proper to designate as "artificial" are not only not essential to an adequate diet, but when they are used freely may render a diet very one-sided or deficient.

Foods may be so selected as to furnish an abundant supply of mineral ingredients. For instance, the dry substance of certain vegetables like asparagus, lettuce, spinach, and such animal foods as eggs, and beef extracts are relatively rich in iron compounds, and the dried substance of leguminous seeds, carrots and other vegetables, milk, and cheese are relatively rich in calcium compounds.

Variety of foods is necessary, for monotony of even the best kinds leads to satiety, loss of appetite, loathing of food, and subsequent ill-health. Vegetables and fruits are absolutely essential, but raw fruits are not so easily digested as cooked. Salads, lettuce, water-cress, green onions, celery, tomatoes, etc., are so valuable for the juices contained in them that they cannot be too strongly recommended to those who can digest them. Similar juices are contained in cabbage, cauliflower, spinach, etc., but these are lost to a very great measure in the cooking.

Oranges, lemons, grapes, strawberries, and bananas contain equally valuable juices, and may be eaten raw with advantage to the consumer; but apples, pears, plums, gooseberries, and many other fruits are better cooked before being eaten.

The simpler the meals, the less work will be expended in their preparation, and there is no advantage in an elaborate meal. The main thing is that the table should furnish a sufficient variety from day to day.

The following specimen dietary has been found to be most satisfactory for women with sedentary occupations. On it women have maintained good health and other women have regained their health:

Breakfast.—Fruit, bacon and eggs, breakfast hominy, rolls or toast and butter, a glass of milk, and one cup of coffee.

The fruit may be any raw fruit in season except apples or bananas; apples should always be cooked for breakfast because they are more easily digested; bananas are too heavy and indigestible to be served for breakfast. Stewed prunes are good and especially laxative.

Bacon is not a necessity, though it is an appetizer. Eggs may be served in any way, though they are most digestible when soft boiled or poached.

The hominy is boiled in water and served as a vegetable, with a little salt and butter, but *no* sugar.

For women with good digestion and taking more active exercise, oatmeal and cream may be substituted for the eggs, hominy, and glass of milk.

Luncheon may be served in a very appetizing way from the cold meat and vegetables which have been left from the previous day's dinner in the form of stews, baked hash, etc. Stewed fruit should always be served, and oysters always make a nice dish for lunch.

The criticism of the ordinary lunch for women is that it is too light. The food served for lunch should furnish about 1000 calories; 90 per cent. of these should be in the form of starches and fats.

Dinner.—The following is a balanced ration given in the Educational Lunch Room of the New York Department of Health:

	Price.	Quantity.	Calories.	Proteins. Grams.
Vegetable soup........	5 cents.	½ pint.	150	5
Roast beef............	20 cents.	4 oz. lean.	140	30 or
Roast beef with.......	......	4 oz. fat.	460	27
Mashed potatoes, creamed............	......	Av. helping.	110	4.0
String beans..........	5 cents.	2 h. tbsp.	10	.5
Salad a la Sauté.......	8 cents.	Av. helping.	370	2.0
Whole wheat bread....	......	2 slices.	140	5.5
Butter...............	......	½ ounce.	120	....
Apple pie.............	5 cents.	⅙ pie.	300	4.0
Black coffee..........	3 cents.	1 cup.	....	....
Sugar................	......	2 squares.	60	....
	46 cents.		1760 or 1440	50 or 53

One glass of water is served with each meal; it should be taken when the meal is finished.

The mineral waters promote digestion by promoting an earlier and more abundant secretion of the gastric juice.

Lemon juice should be substituted for vinegar in all salad dressings. For a French dressing the correct proportions are 1 tablespoonful of lemon juice and water each to 2 of olive oil. Mix well, and pour over the salad just before serving.

Three meals a day has been found to be the best arrangement, and there should be an interval of five hours between the meals. If possible dinner, which is the principal meal, should be taken at the end of the day, after its work is over, so that comparative repose may be enjoyed after it. It is of extreme importance that the meals be served at the same hour every day. The perfectly healthy woman should never take anything to eat between meals.

A hearty meal should never be eaten when one is exhausted or greatly fatigued. Half an hour's rest before dinner is a great aid to digestion. Sleep directly after a hearty meal is injurious and sometimes proves fatal be-

cause there is a depression of the circulation, and the digestive processes may stop absolutely during sleep.

Preparation of Food.—Fresh meats are highly nutritious, but in order that the nutritive properties may not be lost in the cooking, they must be eaten "rare," that is, beef and mutton should be at least pink.

A roast should be done in a quick oven, so that the albumin shall rapidly coagulate on the surface and prevent the escape of the nutritive juices. Or if the meat is boiled, it should for the same reason be plunged into boiling water.

On the other hand, in treating meats in order to obtain "stock" for soup, the meat after having been cut up into small pieces should be allowed to stand in cold water for twenty minutes and then be put on to simmer for six hours or more.

Plenty of bones with gristle should be gotten with the soup meat; these do not add to the cost, and add materially to the value of the stock; for, while the gelatinoids are not flesh formers, they are admirable protein sparers. The same thing holds true of gelatin and its preparations.

Indigestible Combination of Foods.—The acid of vinegar being a fermentation acid renders the digestion of many foods with which it is taken more difficult, while vegetable acids, such as citric and tartaric, do not cause that objectionable effect. Vinegar also retards salivary and gastric digestion.

Strong tea taken with any meat meal converts the albumin of the meat into a dense precipitate that is absolutely indigestible. The tannin of tea inhibits the salivary and gastric secretions and so retards digestion. Indigestion, atony, or catarrh of the stomach is frequently due to excessive tea drinking, and the artificial stimulation of the nervous system may be carried so far as to produce insomnia, palpitation, muscular tremors, and other signs of nervous irritability.

Claret and coffee both delay digestion.

Water is the best beverage to be taken with meals; but the moderate use of tea and coffee is commendable because they have an invigorating effect arising from the caffein and the essential oils, but their use should not be abused.

The Proper Way of Making Tea.—The water should be freshly boiled; the tea-pot heated so that the water will be maintained at the boiling-point; one teaspoonful of tea is allowed to the cup. The tea is measured out, put into the tea-pot, and the requisite amount of boiling water poured over it. It is then allowed to stand on the kitchen table, *not* the range, for from two to three minutes; it should then be strained into the tea-pot for the table.

Unless the tea is strained off the leaves the infusion continues for some time; this extracts the tannic acid and bitter principles. In addition, the prolonged infusion dissipates the volatile oil, to which much of the fragrance of a good cup of tea is due.

As it is almost impossible to have the requisite amount of care exercised in the making of tea in the kitchen, it is much better that it should be made on the table. Sugar detracts from the healthfulness of the beverage.

Coffee.—Most that has been said about tea is true of coffee. It is aromatic and refreshing, stimulates the mental activity, invigorates the muscular system, and removes the sense of fatigue. The excessive use of coffee often leads to insomnia. Its use retards gastric digestion, but less so than tea; but strong coffee or café noir has a still greater inhibitory effect. It has a slightly aperient effect on the intestines by increasing the peristaltic action. It is also slightly diuretic.

The aromatic oils are dissipated by boiling, and the best temperature of the water is 210° F., or just below the boiling-point.

Defective Methods in the Preparation of Breads which Reduces the Vitamin Contents, Especially of Corn Bread.—By resorting to artificial methods for procuring the light-

ness of breads, baking soda (sodium bicarbonate) is used. In order to prepare bread in this way the cornmeal is mixed with milk or water to which baking soda has been added, and put in the oven to bake. The high temperature of the oven liberates the carbon dioxid (CO_2) from the baking soda, causing the bread to rise, and the sodium bicarbonate is transformed into sodium carbonate, a strong alkali. Recent experiments have clearly demonstrated the destructive action of the alkalies on the vitamins, this being especially true at high temperatures.

It should be strongly emphasized that the old-fashioned way of combining baking soda with sour milk in the preparation of bread is an entirely harmless procedure, provided that sufficient sour milk is added to perfectly neutralize the alkalinity of the soda. The label on some brands of baking soda clearly states that sour milk, or tartaric acid, should be added in order to obtain the best results.

Dietary in the Tropics.—Sir R. Havelock Charles says, "It is impossible to form exact rules for dietary in the tropics because there are differences in climate which require modifications." He says nothing about limiting the amount of meat, but he does say, "no *cold* meat whatever should come on the table." It is important that everything should come straight from the fire to the table. It cannot then cause bacillary mischief, and there should be no fear of cholera or dysentery.

Boiled water only should be drunk. No salads of any kind should be used except in the greatest moderation.

Fruit.—Every fruit which possesses a rind that can be removed may be eaten raw with impunity by a healthy man at any time of the year. Fruits which do not possess a rind are incapable of being thoroughly cleansed; such fruit may be contaminated and dangerous to the consumer, and, at any rate, ought only to be eaten after it is cooked. Therefore oranges, grape-fruit, pears, apples, bananas, mangoes, pineapples, custard-apples, mangosteen, tomatoes, etc., may be eaten raw after peeling them. But it

would be unsafe to eat grapes, currants, strawberries, and other fruits which cannot be peeled until they are cooked.

As regards proteins, some fish, fowl, or meat may be taken for breakfast; animal food ought not to be taken in the middle of the day. It is is better to take dinner in the evening. Beef, mutton, pork, kid (goat-flesh), venison (deer and antelope), poultry, many kinds of birds, eggs, and fish are obtainable in one place or another. Tinned meats and fish should be avoided; indeed, the importance of fresh meat is so great that hunting, shooting, and fishing should be strongly recommended as exercise.

Fat is obtained in the form of meat, dripping, butter, ghee, nuts, and various oils used in cooking. The pure oil from peanuts, palm-nuts, and cocoanuts is salutary; but many samples are adulterated with sesamé oil, poppy-seed oil, and colza oil, which are deleterious by causing dyspepsia or other gastro-intestinal troubles. These in turn render the subject susceptible to dysentery, sprue, and other tropical disorders.

Food Economics: Regulation of Diet with Reference to Minimum Expenditure.—The cost of a meal for an individual or a family is made up of two factors—the money cost of the raw materials, and the time, cost of labor, and other expenses required for the preparation and serving of the food.

The Cost of Raw Food Materials.—Meats of all kinds, poultry, and fish are the most expensive articles of diet. Then, too, the waste has to be considered—the bones and legs of a dressed fowl and the bones and skin of fish.

At the present time the dairy products supply the cheapest nutriment among animal foods, but the price of butter and eggs are apt to soar enormously during the winter months.

Leguminous Food.—The dried pea, bean, or lentil are especially rich in protein, and are thus fit to take the place of a part of meat in the dietary. Their price is low in comparison to their value, and must be considered next to bread

in importance. They are less completely digested than cereals if eaten in any quantity; and, highly nutritious as these are, it cannot be denied that in large quantities they are very indigestible for any but persons with strong constitutions and leading an active outdoor life.

Great care is needed in their preparation. Dried legumes should be soaked in cold water for eight hours, and then boiled for one hour and a half. They are then sufficiently soft to be pressed through a sieve. The skin of peas and beans that have been dried should be removed, for they pass through the intestines unchanged. Soft water should be used in preference to hard, as insoluble lime compounds are formed by the latter with the protein "legumin."

Outside Preparation Expensive.—From the standpoint of food value, white bread is more than twice as costly as the wheat flour from which it is made. A barrel of flour of 196 pounds will make on the average 315 5-cent loaves of bread. The bread costs the consumer $15.75, whereas the flour can be bought at the time of writing for $6.50.

Breakfast foods ready for the table, instead of the cheaper cornmeal, oatmeal, and hominy cooked at home, and bread, cake, and other pastry cost double the amount of the raw materials.

There are, however, other factors which complicate and increase the cost of living. At present the exorbitant cost of labor, cost of fuel, etc., and the amount of the housewife's time consumed are all important factors to be taken into consideration.

The size of the family, the number of small children demanding the mother's attention, the kind of labor in which they are engaged, whether hired help has to be depended on for all the work, etc., are all factors which must be taken into consideration as to whether the outside preparation *is* more expensive than when the labor is performed in the home. This is a matter for every housewife to work out in making her monthly and yearly budgets.

TABLE OF FOOD VALUES[1]

Kind of food, edible portion only.	Percentage composition.					Heat value calories per ounce.	Food values comparison of 1000 grams.
	Water.	Protein.	Fat.	Carbohydrate.	Ash.		
Meats.							
Beef:							
Roast, average	48.25	22.25	28.55	....	1.25	160	1888
Roast ribs, fat	45.20	19.14	39.04	....	.82	122	2057
Boiled, average	39.10	26.30	35.00	....	1.00	175	2268
Broiled steak	44.25	23.45	26.50	....	1.43	100	1942
Corned	51.19	26.32	18.65	....	4.10	80	1810
Veal: Cooked, average	51.88	32.20	11.40	....	1.50	68	1896
Mutton:							
Roast, average	51.00	26.00	22.60	....	1.19	90	1805
Boiled leg	57.67	27.60	14.38	....	1.05	67	1738
Lamb:							
Roast leg	67.10	19.70	12.70	....	.80	66	1318
Various parts	47.25	23.80	28.50	....	1.25	100	1966
Pork: Roast, various parts	45.00	32.00	20.00	....	1.76	90	2122
Organs:							
Heart, cooked, average	62.60	16.60	20.00	....	1.00	70	1370
Kidney, ox, cooked, average	76.15	16.50	4.90	.40	1.20	32	940
Liver, ox, cooked, average	71.00	20.60	4.60	1.80	1.60	38	1150
Sweetbread, ox, cooked, average	71.00	16.80	12.00	....	1.60	51	1157
Tongue, ox, cooked, average	71.00	19.00	9.00	....	1.00	46	1188
Soup, etc.							
Beef-tea	93.00	4.30	.60	1.10	1.10	8	234
Bouillon	96.50	2.30	.10	.20	.90	3	116
Chicken broth	94.00	3.80	.10	1.80	1.00	6	200
Consomme	95.50	2.40	.10	.30	1.10	3	120
Meat hash	80.00	6.50	2.00	9.00	2.40	24	560
Meat stew	84.50	4.60	4.30	5.50	1.10	23	420
Oxtail soup	89.00	4.00	1.50	4.30	1.50	13	278
Pea soup	87.00	4.00	.80	8.50	1.30	15	291
Soup stock, beef	89.10	5.80	1.60	....	3.60	11	324
Tomato soup	89.00	2.00	1.50	5.50	1.30	12	158
Meat juice (natural), average	90.00	5.37	.19	....	1.36	7	269
Fowl.							
Domestic, average	64.00	19.00	16.00	....	1.00	65	1130
Chicken	67.00	22.70	10.00	....	1.00	62	1395
Capon	56.00	21.80	21.00	....	1.30	91	1656
Duck	55.75	17.50	25.00	....	1.00	95	1554
Goose	52.00	16.60	35.10	....	1.20	110	1800
Turkey	55.50	21.10	23.00	....	1.00	85	1679
Roast	52.00	27.80	18.50	....	1.30	82	1872
Roast capon	59.00	27.00	11.50	....	1.30	60	1677
Chicken	66.90	22.00	8.10	....	1.70	58	1298
Boiled fowl	57.60	27.00	12.80	....	1.90	80	1708
Eggs.							
Chicken eggs:							
Raw	73.70	13.40	11.50	....	1.00	45	983
Boiled, white	86.30	12.80	.20	....	.70	16	633
Yolk	50.00	14.80	33.70	....	1.20	106	1883
Fish and Shell-fish.							
Bluefish	78.50	19.10	1.20	....	1.20	27	935
Haddock, fresh	81.40	17.20	.30	....	1.10	21	922

[1] Compiled from Tibbles' "Dietetics, or Food in Health and Disease."

Kind of food, edible portion only.	Percentage composition.					Heat value calories per ounce.	Food values comparison of 1000 grams.
	Water.	Protein.	Fat.	Carbohydrate.	Ash.		
Fish and Shell-fish.							
Halibut steak	74.80	18.50	5.30	....	1.40	35	850
Mackerel	74.80	18.50	6.50	....	1.10	40	1086
Oysters	80.00	10.60	2.60	6.50	1.30	25	655
Perch	75.70	19.00	4.00	....	1.20	33	1049
Salmon, Atlantic	63.60	21.60	13.90	....	1.40	64	1445
Sardines	56.30	24 80	12.70	....	5.00	79	1560
Shad	70.60	18.50	9.50	....	1.30	47	1170
Roe	71.20	21.00	3.80	2.50	1.50	38	1252
Trout:							
Brook	77.70	19.30	2.10	....	1.20	28	995
Lake	69.30	18.30	10.60	....	1.20	48	1190
Salmon	70.80	17.80	10.20	....	1.20	48	1156
Calf's foot jelly	77.50	4.50	....	17.40	.70	26	210
Milk Products.							
Cows' milk, average	87.30	3.50	3.70	4.60	.73	20	320
Skimmed	90.30	4.00	.20	4.60	.83	11	245
Condensed milk, full cream, unsweetened	62.40	10.60	10.80	14.10	2.00	52	973
Full cream, sweetened	20.00	10.50	9.90	57.50	2.10	100	1368
Skimmed and sweetened	26.40	10.40	.90	60.20	2.10	40	1232
Cream, hand skimmed	74.00	2.50	18.50	4.50	.50	56	210
Buttermilk	90.00	3.20	1.20	5.00	.60	10	238
Cheese from skimmed milk	45.30	32.00	16.50	2.00	4.20	85	2140
Butter:							
Best quality	13.00	1.00	82.50	1.50	2.00	225	2371
Second quality	16.00	2.00	73.00	4.00	5.00	203	2235
Margarine	16.00	1.10	76.70	....	6.30	220	2210
Cereal Foods.							
Wheat flour, superfine, white	10.50	11.90	1.60	75.40	.50	114	1283
Entire wheat	10.80	12.20	2.20	73.60	1.00	114	1300
Graham	8.60	12.60	2.40	74.50	1.70	116	1330
Maize	10.90	10.20	4.80	71.00	1.30	....	1242
Meal	12.50	7.10	1.30	78.30	.60	108	1106
Rice	12.40	6.90	.40	79.40	.50	102	1084
Boiled	72.50	2.80	.10	24.50	.20	45	258
Oatmeal, boiled	84.50	2.80	.50	11.50	.70	18	244
Macaroni, cooked	78.40	3.00	1.50	15.80	1.30	26	558
Bread.							
White, best	44.10	7.70	.90	46.90	.30	71	793
Entire wheat	49.10	7.40	1.10	41.70	.50	65	770
Brown (Graham)	47.20	7.70	1.20	42.80	.90	67	780
Gluten bread	38.20	9.30	1.40	49.80	1.30	72	910
Toasted bread	24.00	11.50	1.60	61.20	1.70	90	1126
Zwiebach	5.80	9.80	9.90	73.50	1.00	125	1399
Pies and Puddings.							
Apple pie	42.50	3.10	9.80	43.00	1.80	80	866
Cornflour blanc mange	66.00	2.60	3.10	27.00	1.00	36	456
Custard with crust	62.40	4.20	6.30	26.10	1.00	52	604
Maize pudding (Indian meal)	60.00	5.50	5.00	28.00	1.40	51	628
Rice pudding	60.00	4.00	4.70	32.00	.60	52	608
Tapioca pudding	64.50	3.30	3.20	28.50	.80	45	505
With apples	70.10	.30	.10	30.00	.20	36	289
Roots and Tubers.							
Carrots, boiled	92.50	.50	.20	4.50	.80	8	70

TABLE OF FOOD VALUES (*Continued*).

Kind of food, edible portion only.	Percentaga compositioo.					Heat value calories per ounce.	Food values comparison of 1000 grams.
	Water.	Protein.	Fat.	Carbohydrate.	Ash.		
Roots and Tubers.							
Beets, boiled	91.70	1.40	.10	5.13	1.00	11	102
Parsnips, boiled	92.10	1.30	.30	6.50	.70	11	126
Potatoes, boilad	75.50	2.50	.10	21.00	1.00	26	312
Mashed, with cream	75.10	2.60	3.00	17.80	1.50	31	364
Fried in fat	2.20	6.80	39.80	46.70	4.50	166	1807
Vegetables.							
Asparagus, cooked and buttered	91.60	2.10	3.30	2.20	.80	30	200
Brussels sprouts, boiled	93.70	1.50	.10	3.40	.20	6	98
Cabbage	85.50	2.30	.70	6.10	1.70	9	89
Boiled	97.00	.60	.10	1.40	.20	3	41
Cauliflower, boiled	97.30	.60	.10	1.40	.50	....	41
Celery, boiled	97.00	.40	.07	1.00	.50	....	26
Green peas, boiled	73.80	6.70	2.50	14.60	1.50	34	588
Beans, atring, boiled	89.20	2.30	.30	7.40	.80	12	176
Salads.							
Celery	94.50	1.10	.10	9.70	1.00	13	144
Cucumber	94.90	.70	.20	3.10	.50	4	64
Endiva	93.00	1.00	.10	3.00	.60	8	73
Lettuce	93.80	1.80	.60	4.80	1.20	9	138
Onions	87.60	1.60	.30	9.50	1.10	13	167
Radishes	91.80	1.20	.10	5.60	.70	5	107
Tomatoes	91.80	1.20	.10	5.60	.70	5	107
Watercress	92.80	.70	.40	4.00	1.20	6	79
Dried Legumes.							
Peas	9.50	23.80	1.80	60.30	2.60	104	1544
Haricot beans	12.60	22.50	1.90	59.60	3.50	100	1654
Butter beans	10.50	20.60	2.00	62.60	4.20	102	1519
Nuts.							
Almonds, dried	4.80	21.00	54.90	17.30	2.50	189	2645
Brazil nuts	5.40	18.00	66.00	8.00	2.70	204	2606
Butter nuts	4.50	28.00	61.00	3.50	2.90	192	2956
Chestnuts	4.80	11.60	15.30	65.70	2.60	117	1537
Cocoanut, fresh	19.20	5.40	51.00	10.00	1.20	108	....
Hazel and filbert nuts	48.00	8.00	28.50	11.50	1.50	160	....
Peanuts	9.20	26.00	38.60	24.20	2.00	160	2071
Walnuts, dried	4.90	15.50	62.70	7.50	1.90	190	2364
Fruits.							
Apples:							
Raw	85.20	.40	.50	12.60	.30	18	149
Cooked and aweetened	66.10	.20	.80	37.20	.70	46	395
Dried	28.10	1.60	2.20	66.10	2.00	84	753
Apricots	85.00	1.10	....	13.40	.50	18	176
Canned	81.40	.90	....	17.30	.40	21	208
Bananas	75.70	1.30	.50	21.70	.70	29	276
Blackberries	86.30	1.30	1.00	8.40	.50	17	120
Cherries	82.00	.90	.80	14.30	.60	23	197
Cranberries	88.90	.50	.60	4.00	.20	14	76
Dates, dried	20.00	3.50	2.30	69.00	1.30	101	885
Figs, dried	22.70	4.30	.70	62.50	1.30	80	805
Grapes, fresh	80.50	.90	.80	14.70	.50	28	201
Dried, raisina	18.60	3.00	2.80	70.60	2.70	100	870
Jam, or presarva, average	30.50	1.50	....	60.00	.50	70	744

Kind of food, edible portion only.	Percentage composition.					Heat value, calories per ounce.	Food values comparison of 1000 grams.
	Water.	Protein.	Fat.	Carbohydrate.	Ash.		
Fruits.							
Melon	89.50	.60	.30	7.20	.80	11	103
Oranges	82.80	.90	.20	10.60	.70	15	146
Peaches	88.80	.50	.20	9.20	.80	12	117
Canned	88.10	.70	.10	10.80	.30	14	128
Pears	80.90	.90	.50	15.70	.40	18	203
Canned	81.10	.30	.30	18.00	.30	22	195
Pineapples	89.30	.40	.30	10.00	.90	13	112
Plums	74.50	.90	.20	19.10	.50	24	200
Prunes:							
Dried	22.30	2.10	.20	73.30	2.30	86	724
Stewed	76.60	.50	.10	22.30	.50	27	243
Raspberries	86.20	.50	....	5.60	.50	16	76
Strawberries	94.00	1.00	.60	8.80	.60	12	144

The Physiologic Action of Moderate Doses of Alcohol.—The result of a series of experiments by Dr. Parke were as follows: "By quickening the action of the heart, it shortens the interval of rest, and, therefore, interferes with the nutrition of the heart. It also produces palpitation and breathlessness. Even small doses of alcohol, by increasing unnecessarily the action of the heart, are injurious. It acts on the nervous system by lessening the rapidity and the delicacy of the impressions, as well as by lessening the power of control of a train of thought. Further, by this same blunting of the nervous system, voluntary muscular power is impaired, and the finer combined movements are less perfectly made. It causes a lowering of the temperature of the body, and, although it is taken to overcome the effects of exposure to cold, it has been learned that persons who take it are less able to resist the exposure to cold."

As the result of modern scientific investigation and experimentation, alcohol with its compounds has been taken out of the list of beverages, where it has heretofore been classified with tea and coffee, and out of the list of foods, to which class it had been admitted because of the known oxidation of alcohol in the body, and has been placed in that list of drugs known as narcotics, alongside of ether,

chloroform, opium, and cocain—all of them, the most deadly drugs in the Pharmacopeia, yet, when used by skilled hands, the most beneficent.

The first effect of this class of drugs is a short temporary stage of exhilaration, more or less rapidly followed, according to the amount taken, by a stage of sleepiness or actual insensibility, which lasts longer than the stage of excitement, and this in turn is followed by a long period of depression.

Like other members of its class, alcohol has a cumulative action, the residual quantities habitually taken accumulate and gradually affect the efficiency and well-being of the individual.

A point that must always be borne in mind in giving any medicine is that not a few drugs have a curious tendency to induce a craving for their repetition.

The amount of alcohol contained in some of the most commonly used of the alcoholic beverages is as follows: beer, 4 to 5 per cent.; hard cider, from 5 to 10 per cent.; claret, 8 to 11 per cent.; port, 9 to 22 per cent.; champagne, 10 to 15 per cent.; rum, gin, and strong liquors, 40 to 50 per cent.; whisky, 44 to 50 per cent.; brandy, 48 to 56 per cent.

These alcoholic beverages are often made still more harmful by adulterations by ingredients in themselves harmful.

A large percentage of alcohol is also found in bitters and patent medicines.

We will consider the subject of alcohol under the following aspects: First, the question of alcohol as a food; second, the effects of alcohol on the digestive system and the metabolism; third, the effects of alcohol on the heart and the muscular system; and fourth, the effects of alcohol on the nervous system.

First, Is Alcohol a Food?—The substances used as foods act in providing energy for muscular work, in maintaining the heat of the body, in building up of the tissues, and in saving the waste of the tissues. Moreover, a food which

does harm to any organ, or to the system as a whole, when taken in moderate repeated quantities, becomes a poison for that individual.

A food may be defined as any substance which, when absorbed into the blood, will nourish, repair waste, and furnish force and heat to the body, without causing injury to any of its parts or loss of functional activity. From any one of these four standpoints alcohol cannot be regarded as a food.

The physiologic effects of alcohol and real food-stuffs are totally different. Fats, carbohydrates, and nitrogenous foods after mastication at once begin to be digested and assimilated, and to fulfil the true functions of a food by maintaining a natural temperature, pulse-rate, and tissue repair of the body, without any disturbance of its mental and physical functions and activities.

Alcohol, on the contrary, is absorbed from the stomach unaltered by the digestive processes; circulated in the blood in its original form, it at once interferes with the ordinary activity of the brain and other organs, and, by its anesthetic action, hampers the mental and physical activities and interferes with the processes of metabolism.

The Effects of Alcohol on the Digestive System and Metabolism.—The local action of alcoholic liquids is particularly destructive on an empty stomach; and when taken in strong solution, but it is also known that smaller doses, taken continuously, are liable to effect the digestive organs in a slower though similar way.

The injurious effects of alcohol are that it acts as a local irritant, producing dilatation of the blood-vessels of the stomach and subsequent gastritis; it leads to hyperacidity, by stimulating the secretion of hydrochloric acid; the tartrates and malates contained in wine are decomposed in the stomach, setting free organic acids, and thus producing acidity; the acetic acid and yeast in beer set up an acetic acid fermentation in the stomach-contents.

Whether taken alone or with food, the tendency of alcohol throughout is to lessen the churning movements of the stomach, and leads to atony of that organ, which in turn leads to dilatation of the stomach.

Alcohol appears to have a particularly deleterious effect on the digestion of women. This is explained by the fact that men lead a more active outdoor life, and consequently retain their appetite for food longer than women. For the same reason, they are able to work off the effects of drinking more easily and start afresh the assimilation of food. The indoor life led by women, their clothing, worn tight around the stomach, are added causes for lack of appetite. Catarrh of the stomach results; this is followed by insufficient food and an increased amount of stimulants. There follow nausea, irregular and insufficient nutrition, indigestion, and a faulty elaboration of the food.

By its action on the liver alcohol interferes with the amount and quantity of bile, and so inevitably leads to indigestion and constipation, and a similar interference with the action of the liver-cells and their chemical changes set up in many cases gouty conditions, accompanied by mental depression and irritability.

Diseases of the liver occur more frequently as the result of taking frequent small doses of alcohol, though never reaching the stage of intoxication, than as the result of indulging more freely, but at longer intervals.

The Effect of Alcohol on the Blood.—The blood is a mixture of corpuscles and a fluid known as the blood plasma. The corpuscles are of two kinds—red and white. The red blood-corpuscles are the oxygen carriers; they carry the oxygen to the tissues, where they readily give it up. They are constantly being destroyed by the liver and spleen, and are replaced by new ones, which come from the red marrow of bones. The white corpuscles are much fewer in number, but they play a most important part in protecting the body against disease. It is now about twenty years since Professor Metchnikoff, of the Pasteur Institute

of Paris, announced to the world his discovery that the white corpuscles have the power of destroying the microbes to which so many diseases are due. These white blood-cells form the standing army or policemen of the body, and their duty is to attack, and, if possible, to destroy, any foreign matter, such as dust or disease germs.

The plasma of the blood contains various kinds of salts, and include sodium chlorid or common salt, the phosphates, and chlorids of calcium and potassium.

The way which the body fights disease is partly by means of the white blood-corpuscles, which totally destroy the germs, and partly by the increase in the blood of those chemical substances which are antidotes for the poisons given out by the germs.

Alcohol taken into the stomach is quickly absorbed and reaches the blood in two minutes. The maximum of alcohol is found in the blood in fifteen minutes after it is swallowed.

The blood is the medium by which food and oxygen are conveyed to the tissues, and by which the refuse material from the tissues is carried away; alcohol interferes with both these processes.

The red cells are liable to become damaged and anemia results. It has now been proved that even tiny doses of alcohol paralyze more or less the white cells, and thus interfere with their power of destroying microbes. Chemical substances tend to exert a delaying or inhibitory influence over the chemical processes of the body. These chemical processes are oxidation, the storing up of nutriment, the manufacture of secretion, the production of energy and muscular movement, and the excretion of waste materials.

The greatest possible difference exists as to the rate at which oxidation goes on. When there is nothing to hinder its occurrence, the poisonous toxins and waste matters are rapidly burned up and eliminated and health prevails. Alcohol, by its affinity for oxygen, robs the tissues of

oxygen which they would otherwise use for combustion. Hence the tissues are kept starving for oxygen, metabolism is interfered with, and they cannot get rid of their waste material.

This delayed oxidation tends to increase the body weight. The cells in an intermediate stage of fatty degeneration clog the body, and, of course, add to its weight. The natural effect of taking alcohol is to make the body obese. On abstaining from alcohol, the superfluous tissue is often burned away, and the weight of the body reduced, and a look and feeling of youth is recovered.

The Effect of Alcohol on the Heart and Circulation.—By the circulation we understand the driving of the fluid blood around the body, through the blood-vessels, such driving being maintained by the pumping power of the heart, which is practically a hollow muscle.

In consequence of this pumping power of the heart, the blood in the vessels is under considerable pressure, which is naturally increased if the blood-vessels are narrowed or contracted, and diminished if the blood-vessels are expanded or dilated.

Gradual deterioration in the heart power is a cause of premature death. One of the early indications that the foregoing changes may be occurring in a heart is a sense of fatigue and breathlessness on slight exertion, or a feeling of disinclination for normal effort. The result of such depression of the efficiency of the heart is often seen when the individual is attacked by some disease; she succumbs to heart failure, instead of being able to resist the disease. This probably accounts for a great many deaths between forty and sixty years of age.

Further, it must be remembered that all the nutritive action of the blood depends on its power of rapidly filtering through the walls of the blood-vessels to the tissues, and, conversely, its power of drawing off the waste-products of the tissues depends on the facility with which such products can penetrate its walls.

As soon as degeneracy sets in, the walls of all vessels

tend to become thickened, and the active transference through them, more and more prevented; the nutrition of the body is thus gravely hampered, and, with the advance of this thickening of the walls, the vessels are less able to adjust themselves to the variations in pressure from within; and, finally, when unable to withstand the pressure, they rupture, causing hemorrhage and apoplexy, which, when occurring in the brain, cause paralysis and mental decay.

A similar degeneration takes place in old age, but the point is, that many persons, instead of waiting until old age comes to them, deliberately precipitate these senile changes.

The Effect of Alcohol on the Kidneys.—The elaborate mechanism of the kidneys consist of a filtering system of thousands of tubules, arranged closely side by side, whose function it is to carry away from the body the waste material, which otherwise would interfere with the vitality of the different organs.

The part played by the kidneys in rapidly eliminating effete material cannot be too carefully safeguarded. Anything which interferes with its work will sooner or later cause a retention of waste-products in the system, and will also permit of the escape of valuable albuminous materials of the substance of the blood through the filtering apparatus. The effect of alcohol upon the kidneys can only be described as disastrous. In proportion as the kidney shrinks, there is a diminution of the excretion of urine, and, finally, the condition known as Bright's disease is established.

The Effect of Alcohol on the Muscular System.—The muscular tissue forms 43 per cent. of the body weight. It has been proved that under the moderate use of alcohol the muscles become flabby and less vigorous and effective; that troops cannot work or march on alcohol; that in training for athletics, for races, or for other sports, total abstinence is always practised; the true sportsman depends quite as much on his brain as on his muscles for

success. In England it is recognized that total abstinence is a necessity where great exertions are concerned, and it is now beyond all question that alcohol, in even so-called dietetic quantities, diminishes the output of muscular work, both in quantity and quality, and that the best physical results are obtained under total abstinence from its use.

Alcohol actually lowers the temperature of the body from three-fourths of one degree to three degrees. This depression of temperature is not transient, but lasts for several days, so that its use, when the person is exposed to intense cold, is extremely hazardous to life.

The Effects of Alcohol on the Nervous System.—Kraepelin has carried out a series of experiments to prove the effects of small doses of alcohol on the output of work. In all mental work there are two elements to be considered, namely, quality and speed. Now, all observers are agreed that the quality of mental work is affected even before speed, more mistakes being made. Tests were made in reading aloud; in adding figures in various combinations; in type-setting; and in memorizing; in all these instances it was found that, after taking moderate doses of alcohol for a number of consecutive days, the work done was less, was less accurate, and that there was a decrease in the power of memorizing.

Another series of investigations, made by Rudin to determine how long the intellectual abilities continue to be depressed after the effects of alcohol pass off, showed that the effects of a single dose of alcohol persisted until noon or evening of the next day.

Von Helmholtz, one of the greatest observers and thinkers of the nineteenth century, noted on himself the effect of alcohol in interfering with the highest powers of thought and conception. Describing the conditions under which his highest scientific thoughts had matured and come to fruition, he said: "As far as my experience is concerned, they never come to a wearied brain or at the writing-desk; they were especially inclined to appear to

me while indulging in a quiet walk in the sunshine or over the forest-clad mountains, *but the smallest quantity of alcohol seemed to drive them away.*"

Professor Sikovsky's testimony is that "alcohol diminishes the rapidity of thought, makes the imagination and the power of reflection commonplace and deprived of originality, acts upon fine and complex sensations by transforming them into coarse and elementary ones, provokes outbursts of evil passions and dispositions, and in this predisposes men to strife and crime, and upsets habits of work and perseverance."

Self-control is one of the highest functions of the brain, and the racial power which results to a people as a consequence of the individual practice of self-control cannot be too highly estimated. Therefore, children are trained as far as possible to control their emotions and actions. Alcohol diminishes and breaks down this power of acquired self-control, undoing the work of parents and educationalists. Quite small doses are often responsible for reckless and self-pleasing actions, which are far reaching in their results in loss of moral tone and self-respect. The ideals of duty are lost sight of, and, at best, leave the individual in a laissez-faire attitude. Among the depressant effects of alcohol are intellectual lethargy and a sense of fatigue, which, combined with the other factors, lessen the capacity for genuine enjoyment and pleasure.

CHAPTER V

THE RESPIRATORY AND CIRCULATORY SYSTEMS: THE KIDNEYS

The Mechanics of Circulation and Respiration; the Circulatory Apparatus; the Lungs; Hygiene of the Lungs and Its Relation to the General Health; Relation of Respiration to Body Heat; the Respiratory Functions of the Abdominal Muscles; the Importance of Good Chest Development; Proper Relation Between the Height, Weight, and Chest Measurements; Chemical Properties of Air; Town and Country Air; Dust and Its Relations to Disease; Rôle Played by Bacteria; Ventilation; the Injurious Effects of Overheated Air; the Proper Degree of Moisture for the Air of the House; Ventilation of Bed-rooms.

Care of the Nose, Throat, and Ears; Impediments to Respiration; Ventilation of the Lungs and Breathing Exercises; Cure of Chronic Bronchitis by Deep Breathing Exercises; Relation of Colds to Pneumonia and Tuberculosis, and Their Prevention.

The Kidneys and Their Function; the Physiology of the Female Pelvic Organs.

It is said that diseases of the lungs are the cause of four-fifths of all indispositions, ill health, and actual disease among civilized people, and that, between the age of fifteen and twenty-five, almost one-half of the mortality is due to pulmonary tuberculosis.

This almost universal weakness of the lungs, as it may be styled, is a product of modern civilization, and is caused by our unhygienic mode of life. Too little importance is attached to physical development, and well-developed lungs can only be found in a well-developed chest; too little time is spent in outdoor exercise; and private houses, public conveyances, and public assembly rooms are not properly ventilated.

Good development of the chest and lungs, and thorough and systematic ventilation of the lungs, are essential to a strong heart, a vigorous circulation, and power of the tissues to resist disease.

The Mechanics of Circulation and Respiration.—In order to understand the mechanics of circulation and respiration, it is necessary to appreciate four fundamental facts—that the thorax is a distensible, air-tight cage; that it contains and is filled by the heart, lungs, and great blood-vessels; that the exchange of gases in the blood takes place in the lungs; and that, on the development of the chest and respiratory muscles, depend the development of the lungs and the force of the circulation.

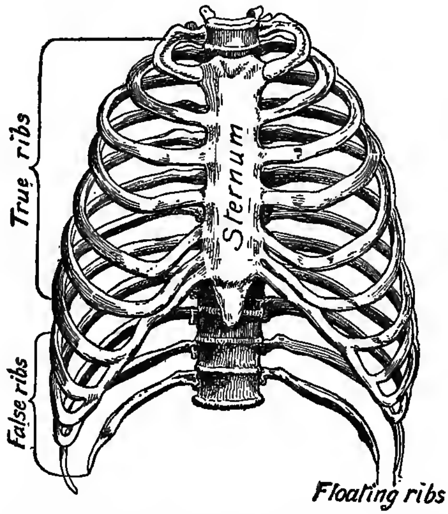


Fig. 7.—The bony thorax, anterior view (Ingals).

The Thorax.—The chest or thorax is a cone-shaped, distensible cage, formed of bones, elastic cartilage, and muscles. The spinal column forms the fixed part of this living cage, and the ribs are attached to this in such a way as to allow of their being raised in inspiration, thus increasing the anteroposterior and the lateral diameters of the chest.

The thorax is converted into an air-tight cavity by

means of muscles. The base is made up of one huge muscle, the diaphragm. This is attached at its border to the ribs and posteriorly to the backbone. It is the diaphragm which separates the cavity of the thorax from that of the abdomen. When the diaphragm is relaxed, it has a concavoconvex form, the convexity being directed toward the chest, and the heart and lungs rest directly on it, while the concave surface covers or rests on the liver.

The Circulatory Apparatus.—This consists of a central force and suction-pump, the heart, and a series of elastic tubes that grow smaller the further from the heart they are situated; they divide and subdivide, like the branches of a tree. The smallest arteries, called capillaries, from their hair-like size, are so minute that they only allow the passage of a single corpuscle at a time and their walls are transparent.

The heart is a somewhat cone-shaped organ, placed between the two lungs; it is situated more or less obliquely in the chest, immediately back of the breast-bone. Roughly speaking, the base of the heart corresponds to the right edge of the sternum, while the apex lies a little below and to the right of the left nipple.

The heart is divided into a right and left side. The left side forms the force pump, whose motive power is supplied by the contraction of its own muscle-fibers. The bright red blood, with its fresh supply of oxygen—hence its color—flows from the lungs into the left heart, which then contracts automatically and forces the blood into the arteries of the body.

The arteries consist of a series of elastic tubings; hence, the smaller the tubing, the greater the resistance which has to be overcome by the force of the heart's beat, so that during violent exercise, when the contraction of the muscles causes a pressure on the minute arteries and capillaries situated in them, the more forcible must be the beat of the heart to overcome this additional resistance. Likewise, when the surface of the body is suddenly

chilled, as by a plunge into cold water, all the vessels situated here contract, and, again, more work is thrown on the heart.

The three chief factors in the mechanics of the circulation are the force and frequency of the heart's beat, the peripheral resistance, and the elasticity of the arterial walls. Any disturbance between these relations brings about abnormal conditions.

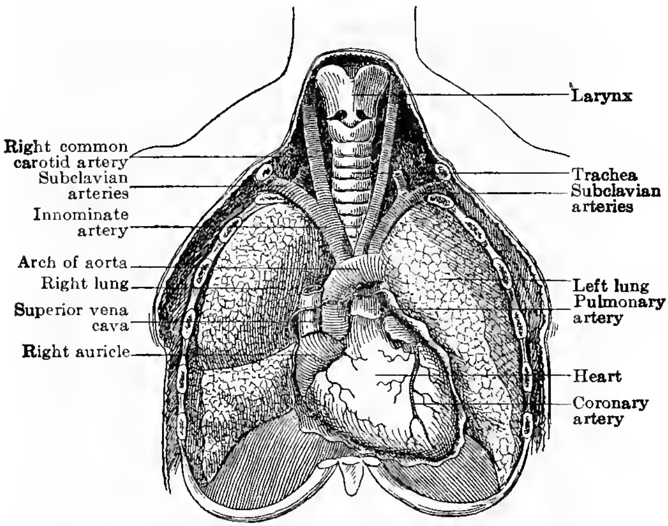


Fig. 8.—Front view of heart and lungs, showing relations to other thoracic organs (Ingals).

The average frequency of the heart's beat, or the pulse, is 72 times a minute. It is increased by exercise; it is quicker in the standing than in the sitting posture. It is quickened by meals, and, on the whole, it is quicker in the evening than in the early morning hours. Independent of muscular exertion, it is quickened by great altitudes. It is said to be quicker in summer than in winter. Its rate is profoundly influenced by mental conditions.

The whole of the blood of the body passes through the heart in 32 beats—that is, in less than half a minute. The greatest part of this time is spent in the capillaries, There the tissues are obtaining their fresh supplies of food and discharging their waste matter into it.

The heart, great blood-vessels, and the lungs are placed in the air-tight cavity of the thorax, and are subjected to the pumping action of the respiratory movements. The inspiratory muscles elevate the ribs, at the same time that

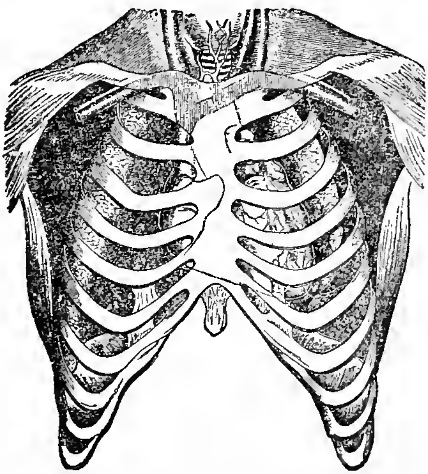


Fig. 9.—Relation of heart and great vessels to the wall of the thorax. The collapsed lungs are drawn slightly aside (after Heath).

the diaphragm, by its contraction, pushes the contents of the abdomen downward. The cavity of the chest, so enlarged, causes the pressure around the heart and the great blood-vessels within the chest to be less than that on the blood-vessels outside the chest; hence, during each inspiration the venous blood is sucked back into the right side of the heart.

The tissues deprive the blood of its oxygen, so that which flows back to the heart in the veins is blue. The right

heart then sends this blue blood to the lungs, that it may get rid of its carbonic acid, which is not only not needed, but is actually injurious to the body, and to receive a fresh supply of oxygen, which has been carried into the lungs in breathing.

The *blood* is the great medium of exchange between all parts of the body. It is, at the same time, the nourisher and the scavenger of all the tissues. After the food has been liquefied and converted into new substances in the digestive system it is poured into the blood. From the blood all the tissues draw material to renew their own worn-out parts and other material which they store up

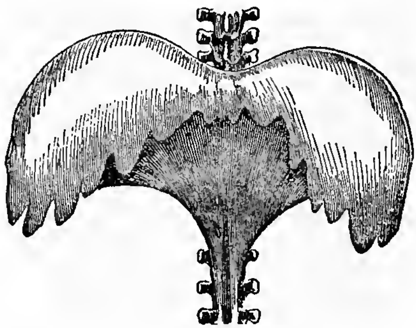


Fig. 10.—The diaphragm (after Kitchen).

as latent force, which, when it unites with the oxygen of the blood, becomes active force, such as heat and motion.

The blood holds in suspension a vast number of minute cells or corpuscles; the red corpuscles give its color to the blood, and are the oxygen carriers, while the white are the phagocytes or the protective agents of the body against disease.

The blood constitutes about one-thirteenth of the body weight. Of this, one-fourth is distributed to the heart, lungs, and great blood-vessels, one-fourth to the liver, one-fourth to the skeletal muscles, and the remainder to other organs.

In order that the blood may be a satisfactory medium of exchange between all the tissues of the body two things are necessary—first, there must be through all parts of the body a flow of blood of a certain rapidity and general constancy; and, second, this flow must be susceptible of general and local modifications.

The **lungs** are the essential organs of respiration or ventilators of the body. They are two in number, separated from each other by the heart, are placed in a semidistended state in the air-tight thorax, which we have seen they, together with the heart and great blood-vessels, completely fill. The lungs ultimately consist of air-cells, surrounded by dense plexuses of capillaries and nerves. The air-cells communicate with the exterior through the bronchial tubes, trachea, larynx, throat, and nose.

The larynx is the organ of voice. It is situated between the trachea and the base of the tongue, at the upper and back part of the neck, where it forms a considerable projection in the middle line, called Adam's apple.

The trachea is a cylindric tube, which extends from the larynx downward about 4½ inches, when it divides into the right and left bronchial tubes. The bronchial tubes, on entering the lungs, divide and subdivide, until finally they terminate in a lobule which is composed of air-cells and intercellular passages.

In inspiration the cavity of the thorax is enlarged by an active contraction of the muscles, in consequence of which the pressure of air within the lungs becomes less than that of the air outside of the body, and this difference of pressure causes a rush of air through the trachea into the lungs, until an equilibrium of pressure is established between the outside air and that within the lungs. This constitutes *inspiration.* Upon the relaxation of the respiratory muscles, the elasticity of the chest-walls and lungs, aided perhaps, to some extent, by the contraction of certain muscles, causes the chest to return to its original size. In consequence of this, the pressure within the

lungs now becomes greater than that outside, and the air rushes out of the trachea, until the equilibrium is once more established—*expiration.*

During quiet respiration all parts of the lungs are not equally expanded; it is chiefly the apices of the lungs, reaching up into the region of the neck, and the central parts of the lungs, which undergo the least change of volume. This lack of a thorough distention and aëration of every part of the lungs is a cause of weakness of the lungs as well as of the entire body, for it is precisely those parts of the lungs which are the least active that are most prone to become the seat of tuberculosis.

In forced inspiration the cavity of the thorax is increased from 2 to 3 inches, partly by the elevation of the ribs and partly by the descent of the diaphragm, due to the contraction of its muscular fibers. In contracting, the diaphragm presses upon the abdominal viscera, pushing them downward about 3 inches, so that a projection of the flaccid abdominal walls occurs. The movements of the diaphragm are less extensive in women than in men, which is believed to be due to the corsets and general manner of dress. A perfectly free mobility is necessary for change in the size of the chest and lungs, in which the respiratory movements take place from sixteen to twenty times a minute.

The amount of air entering and leaving the lungs varies greatly in ordinary and forced respiration, being often three times as much in the latter. The volume of air is determined by the spirometer. Mr. Hutchinson, who invented the spirometer, has defined the vital capacity of the lungs as that amount of air which can be expelled by the most forcible expiration, and so the measure of the individual's respiratory power. The vital capacity varies according to a number of conditions, as age, sex, weight, but, most important of all, is the height. It has been found that between five and six feet the vital capacity increases eight cubic inches for each inch in height.

The vital importance of the rôle which oxygen plays in the health and life of the individual may be better understood from the facts that about 10,000 liters of air are breathed daily, which makes the amount of food and drink consumed daily seem almost infinitesimal, and, important as the quality of the food is, the quality of the air is much more so, and, finally, that one can live for some days without either food or drink, but dies in a few minutes if the supply of air is cut off.

Secretion of the Lungs.—Like the lips and mouth, the lungs are invested on their free inner surface by a delicate mucous membrane, which constantly secretes a clear viscous fluid, the mucus. The lungs, therefore, like the nose, are always moist, and just as the nose is cleared by blowing it, so the lungs are cleared by hawking or coughing. A sense of discomfort or a feeling of irritation of the windpipe induces a deep inspiration, followed by an explosive expiration, which quickly brings up the mucus, so that it can be expectorated. The only difference between the mucus of the lungs and that of other organs is that the former is mixed with air and has, therefore, a frothy appearance.

The secretion of the lungs naturally flows down and accumulates, until it is voluntarily brought up and expelled. Any one with a cold on the chest, or who is subject to catarrh, will notice that, on moving about in the morning in making the toilet, especially on raising the arms to dress the hair, expectoration is greatly facilitated, and that this is followed by a feeling of clearing out of the throat and lungs.

Because of the great aid given to the lungs in clearing them of mucus, moderate exercise in the open air is a much better treatment of an ordinary cold than a prolonged stay in bed. And for the same reason, in the treatment of lung troubles, so soon as the temperature of the patient is down to normal, and her strength makes it safe to allow her to move about, the recovery of the patient is hastened by getting up and moving about the house.

Hygiene of the Lungs and Its Relation to the General Health.—Two conditions are essential for the preservation of the health and prevention of diseases of the lungs—good chest and lung development, and a continuous supply of fresh air for the proper ventilation of the lungs.

Fully one-third of the whole volume of blood is always circulating in the lungs, and each corpuscle passes through them 8000 times in the twenty-four hours. In other words, the lungs are the vitualizing stations of the corpuscles which unceasingly go hurrying by. If these carbonic-acid-laden corpuscles arrive in the lungs, and do not find the requisite amount of oxygen awaiting them, they return to the tissues, carrying part of their carbonic acid back to them instead of a fresh supply of oxygen, and so the tissues are weakened instead of being nourished, while the corpuscles themselves suffer from lack of proper nourishment and deteriorate in form and color. Imperfect ventilation of the lungs is the most frequent cause of anemia or thinness of the blood.

It must not be overlooked that the air may be fresh and pure, and yet not able to penetrate all parts of the lungs because of superficial and improper breathing.

Relation of Respiration to Body Heat.—The heat of the body is generated by the oxidation of the tissues. The chilliness experienced by persons engaged in sedentary occupations is by no means always caused by the low temperature of the room, as will be proved by the thermometer, but by the close air of the room and superficial respiration, which causes internal overheating with imperfect combustion. The correctness of this statement may be proved if the woman will throw the windows wide open and take deep breathing exercises for five minutes. She will then go back to her work thoroughly comfortable. In other words, she has breathed herself warm.

The Respiratory Function of the Abdominal Muscles.—Woll-developed abdominal muscles play an im-

portant part in expiration, hence, in emptying the lungs of their impurities. Under normal conditions the pressure in the abdominal cavity is greater than that of the atmosphere; hence in the elastic recoil following inspiration, the abdominal viscera constitute a buffer, so to speak, and drive the diaphragm upward.

The chief causes of flabby abdominal muscles, with its consequent low intra-abdominal pressure, are a sedentary life, the wearing of corsets which prevent the free play of the abdominal muscles, and the overdistention of the abdominal walls by repeated pregnancics and by the accumulations of fat.

As a result of lax abdominal walls, there is very frequently an enteroptosis or a falling of the abdominal contents far below their normal position; this includes the liver, spleen, pancreas, the intestines and stomach, and is the most frequent cause of floating kidney.

Further, the accelerating influence of the diaphragmatic movements on the circulation is seriously interfered with.

The Importance of Good Chest Development.—The least chest development of the adult woman—that is, the underarm girth around the chest—consistent with good health is 28 inches, and this girth must be enlarged 3 inches on forced inspiration. In ordinary respiration the waist expansion should be from ½ to 1 inch, while during muscular activity it should be from 1½ to 3 or 4 inches.

In women the movements of the upper part of the chest are very conspicuous, the breast rising and falling with every respiration; whereas, in children and in men the movements are almost wholly confined to the lower part of the chest, and are called diaphragmatic, in contradistinction to those seen in women, which are called thoracic. It is now the opinion of many observers in this country and in Europe that the habit of thoracic breathing in women has been brought about by constricting the waist and the lower ribs. Observations made among the Indians and Chinese women show that the abdominal is

there the type of breathing, *and* civilized women who wore no corset had relatively good abdominal breathing. Further, that a thoracic type of breathing can be produced in man by putting him in a corset.

Vital capacity is, as we have seen, the term employed to denote the amount of air that can be expired after the fullest possible inspiration. The amount for persons 5 feet in height has been estimated as 174 cubic inches, with an increase of 8 cubic inches for every inch in height above this. The relation between height and vital capacity is rather remarkable, since height is chiefly determined by the length of the legs, and not by the size of the trunk and thorax. This is due to the fact that mobility of the chest increases with stature.

The capacity of the chest is determined by the spirometer. A person who can only blow, say from 180 to 250 cubic inches, has a good pair of lungs, while, on the other hand, an ability to blow only 100, even where percussion and auscultation had revealed nothing, is suspicious.

One test by the spirometer is not sufficient to judge of the condition of the lungs, since the woman may be nervous or may not understand how to breathe into it, so that a number of tests should be made on different days, which may give a much better result, though no change has occurred in the lungs.

Proper relation between the height, weight, and chest measurement:

Height. Feet.	Height. Inches.	Average weight. Pounds.	Average chest measurement. Inches.
5		120	29.80
5	1	122	30.60
5	2	125	35.00
5	3	128	35.75
5	4	131	36.25
5	5	135	37.00
5	6	139	37.50
5	7	143	38.00
5	8	147	38.50
5	9	151	39.00

The Chemical Properties of Air.—It is of more vital importance that the air which we breathe should be pure than the food which we eat should be, although the latter is universally conceded to be a matter of prime importance. The reason is that the poisons in the air, inspired by the lungs, pass directly into the blood, whereas, taken into the stomach, the action is much slower, and there is at least the possibility of their passing through the digestive tract unassimilated.

The olfactory nerves are the normal guides as to the purity of the air, and, if they have not been dulled by long usage in breathing impure air, they are extremely sensitive to impurities in the atmosphere.

Country Air.—In the open air there is a constant, even though insensible, movement of the currents of air; the result is a constant renewal or ventilation of the air. There is, in addition, the evaporation from brooks, rivers, lakes, the dew and rain, which aid in cleansing the air from dust; the peculiar freshness of the air in the country after a heavy fall of rain is familiar to all.

The "bouquet" of the air, most noticeable and delightful in the early morning, especially in the spring of the year, is due to the fragrance given off from the flowers, plants, and trees, and imparts a feeling of exhilaration and a sense of the joy of living.

Sunshine increases the respiratory movements.

Wind clears the air of impurities, and is only harmful when it carries dust with it, or when it is so strong that it impedes the respiration or bodily movements. Very weak persons get out of breath easily when battling against the wind.

Town Air.—Even the outdoor air of towns has its full quota of oxygen,—21 per cent.,—and so is healthier than indoor air. The carbonic acid in the air varies from 0.2 to 0.6 per cent. Among the impurities of the air are smoke, fog, and dust.

Dust and Its Relation to Disease.—Dust, consisting of particles of all kinds of organic and inorganic matter,

is a nuisance of indoor as well as outdoor life. That the dust in cities is the intolerable nuisance and menace to public health that it is, is due to the filthy condition of the streets.

The specific cause of tuberculosis is the tubercle bacillus. Considering the prevalence of the custom of spitting on the pavements, streets, floors of public conveyances, and public halls, that the dust from the streets is carried into the houses on the shoes and the trailing skirts of women, it is self-evident that anything which stirs up the dust, as sweeping, stamping on the floor with the feet, dancing, and on the streets strong currents of air and high winds are a most serious menace to the health and lives of the community.

In addition to the fact that dust is the great carrier of the tubercle bacillus, the particles of dust cause a direct irritation of the mucous membranes lining the nose, throat, larynx, and bronchial tubes.

That dust is an important factor in the causation of colds may be inferred from the facts that they are more common in the city than in the country, and that in the city they are more frequent in the spring and fall, when the streets are not watered.

The Rôle Played by Bacteria.—Bacteria are distributed nearly everywhere and in larger quantities than is generally believed. The air in open spaces in cities contains from 100 to 1000 bacteria per cubic meter, while the air of an inhabited room contains from 6000 to 10,000.

It can now be definitely stated that microörganisms are the immediate or exciting cause of bronchitis observed in diphtheria, in influenza, measles, whooping-cough, pneumonia, etc. These microörganisms are conveyed both directly from the sick to the well, and from the inhalations of the germs floating in the atmosphere. Whenever dust is raised, we breathe in a great number of microorganisms.

In influenza the bacilli are found in the secretions of the nose, throat, and in the expectorations from the lungs.

The bacilli are not only the cause of the acute infections, but also of chronic bronchitis.

The bacterial flora usually present in the throat and the respiratory passages is rich and varied. So long as the mucous membrane lining these passages remains in a healthy condition, an unfavorable condition is offered for their growth and development and these microörganisms are harmless. But just so soon as the general vitality is lowered, or there is an impairment of the normal condition of the epithelium lining the respiratory tract, a culture-medium is provided in which these germs flourish and grow. Anything which will cause an irritation or congestion of the mucous membrane of the throat and bronchial tubes furnishes the necessary conditions for the infection to take place. The germs themselves excite an acute inflammation, and the inflammation extends from the head or throat to the bronchial tubes, through the spread of the infective agent along the respiratory tract.

Ventilation.—Very few people in cities spend more than one hour a day in the open air, which means that they are housed up for the other twenty-three hours, so that no pains should be spared to bring up the quality of the indoor air to approximate as nearly as possible that of the outdoor air. The air of houses contains many more microbes than that of the street.

For dwelling-houses 3000 cubic feet of fresh air is needed every hour. It is said that in the country the only bad air is in farmers' houses, whence it has no chance to escape.

Direct sunlight kills the tubercle bacillus in thin layers of sputum in five or six hours, and diffused sunlight in several days, and proper ventilation greatly facilitates this bactericidal action. A large cubic space is of little avail if the ventilation is inadequate. The windows should be at least one-seventh of the floor space.

The air of the house must be fresh, pure, and cool, to allow proper ventilation of the lungs and skin. Colds are prevalent in winter, because that is the season when people are housed up and breathe impure air.

The commonest causes of impurities of the air in houses are the expired air and the transudation of the skin; the production of the combustion of lights or unconsumed gas may come from the burner when lit, if the pressure is very strong, or the rubber fittings may retain the gas; tobacco smoke; the effluvia of simple uncleanliness of rooms and persons; and the products of the fluid or solid excreta retained in the room. In addition, there may be special conditions which allow the impure air to flow into the room, as from the basement or cellar of a house, from imperfectly trapped soil and waste-pipes, or from other impurities outside of the house.

In respiration the air is vitiated by a decrease in the amount of oxygen and an increase in the amount of carbonic acid; the expired air contains about 4 or 5 per cent. less oxygen and about that amount more of carbonic acid than the inspired air. It has been estimated that an individual takes into her lungs about 500 cubic inches of air per minute and exhales the same amount of vitiated air. The expired air is of a higher temperature, and is loaded with aqueous vapor. The organic substances present in expired air are in part the causes of the odor of the breath; it is probable that many of them are of a poisonous nature. The air is still further vitiated by the products of decomposition of persons having decayed teeth, nasal catarrh, and disorders of the digestive systems, as well as by personal emanations.

When the sensibilities of the sense of smell become dulled, they give no warning of the sense of danger, and the individual may not feel conscious of the harm, although the nervous centers may be greatly depressed, and, because discomfort has not been experienced in a vitiated atmosphere, it does not follow that harm has not been done. The effects are slowly and imperceptibly cumulative, but are on this account none the less injurious, and are now recognized as being among the most potent and wide-spread of all the predisposing causes of disease.

The physiologic effects of breathing vitiated air are that, owing to the impurities of the air, the respirations become quicker and shallower, the heart's action more rapid and feeble; there is a more or less irritation of the mucous membranes lining the nose, throat, and larynx. In extreme cases, where many people are crowded together and the ventilation is totally inadequate, the air often becomes so impure as to cause headache, lassitude, nausea, and fainting.

The long-continued action of such impurities on the olfactory nerves may ultimately induce, through the central nervous system, alterations in the respiration, circulation, and nutrition. When moderately vitiated air is breathed more or less continuously, the individual becomes pale and loses her appetite; after a time there is a decline in the muscular strength and animal spirits. The aëration and nutrition of the blood is interfered with, and the general tone of the system falls below par.

It has further been maintained that metabolism is hindered by much-breathed atmosphere. In addition to the ordinary symptoms of discomfort, the long occupancy of so-called stuffy rooms so lowers the resistance as to be conducive to the contraction of colds and even to more serious infections.

People in this lowered condition of health, which is very common among those who spend the greater part of the day indoors, in offices, houses, schools, factories, and workrooms, offer much less resistance to attacks of acute diseases than do people who lead an outdoor life.

In considering the ventilation of a house, the purity of the air, the temperature, and the dryness of the air must all be considered.

The test now generally accepted as the standard of purity of the air is not the chemical one of the estimation of the amount of carbonic acid contained in the air of a closed space, but that, on entering a room or closed space from the outside fresh air, no sense of impurity or closeness should be noticable.

The so-called natural ventilation of houses, which takes place through the porosity of the walls, the cracks around the doors and windows, is generally too inconsiderable to be taken into account.

Where houses are heated by furnaces, a certain amount of ventilation is furnished by this means, but the air is by no means so pure as the air of a house heated by hot air or steam pipes. In the latter case, the greatest drawback is the dryness of the air.

As the air contained in an inhabited room cannot be kept as pure as the outside air, the object of ventilation is, by the admission of the pure external air, so to minimize the impurities that the air respired may not be detrimental to health.

The most effective means for the ventilation of houses and apartments is the throwing wide open all doors and windows; the windows must be opened at both top and bottom, as the hot impure air rises and the cold air falls to the floor. The length of time which the house should be left open will depend on the outside temperature and the velocity of the winds. This ventilation of the entire house should be carried out three times a day—in the early morning, at noon, and again in the evening.

In addition to this, provision should be made for a constant access of fresh air to the room. A simple and rather primitive method is by raising the lower sash by a strip of wood several inches in height and the exact width of the window. The air will then enter the space between the upper and lower sashes. Some such or any better method of ventilation should be in continuous use, day and night, when the room is occupied. So soon as the weather is sufficiently mild, some of the windows should be left open all the time.

When the air of a room is fresh and pure, the human system is furnished with all the oxygen it can consume, and heat is thus introduced into the body, so that a lower external temperature is necessary for comfort. Hence, supplying a sufficient quantity of fresh air mini-

mizes the amount of coal consumed, besides increasing the vigor of the body.

The temperature of the house will depend on the occupation, age, and health of the inhabitants. With a sedentary occupation, a temperature of from 64° to 70° F. is the most suitable. The temperature of the bedroom at night should not be allowed to fall below 50° F. Every room in the house should be furnished with a thermometer.

The Injurious Effects of Overheated Air.—A rise of temperature in the surrounding air diminishes the amount of oxygen consumed and the amount of carbon dioxid discharged; a fall of temperature has the opposite effect. In addition, this overheated air forms a hot jacket about the body, which prevents the radiation of heat necessary to keep the body in a healthy condition.

For the same reason, when out-of-doors, furs should not be worn close up around the neck, and fur coats should only be worn in the extremely cold weather. Paper and rubber worn about the body act in the same way, by preventing the radiation of heat and moisture—practically steam jackets are formed; the skin is rendered very sensitive and susceptible of chilling on the slightest fall of temperature.

The Proper Degree of Moisture of the Air of the House.—The air below the freezing-point is deprived of much of its moisture; brought into the house, and raised from 70° to 80° F., or drawn into the nostrils and raised to 98° F., it must take up its quota of moisture. This moisture must, therefore, be provided in the air of the house. In the case of houses heated by furnaces, some moisture is furnished by the water-pans of the furnace; but in the case of heating by hot air and steam pipes, there is less circulation of air, the air is very much drier, and generally of a very much higher temperature. A satisfactory method of furnishing these houses with the proper degree of moisture has not yet been invented.

One is only comfortable in a dry air when it is of a low temperature. When the dry air becomes heated, there is

more moisture given off by the mucous membranes, which causes a feeling of dryness and irritation in the nose, throat, and larynx; there may also be a sensation of uneasiness of the chest, and, at the same time, the individual feels chilly.

Persons constantly breathing abnormally dry air lower the resisting power of the respiratory mucous membranes and become very susceptible of taking cold.

Since the degree of moisture of the air of a house is equally important as its temperature, every room should be furnished with a hygrometer, which should register from 65 to 70 per cent. of moisture.

The Ventilation of Bed-rooms.—The importance of the proper ventilation of the sleeping-room will be seen from the fact that two-thirds of the oxygen absorbed in the twenty-four hours is absorbed between 6 o'clock in the evening and 6 o'clock in the morning; and on the state of the air of the bed-room will depend greatly the vitality of the individual. During sleep inspiration occupies ten-twelfths of the respiratory period, while at other times it occupies only five-twelfths of that period. In a closed room the oxygen would eventually be consumed, the air become filled with impurities, and the body languish for want of oxygen and incapacity to throw off its impurities.

The air of the room should be perfectly fresh on retiring; where it has been used as a sitting-room, it should be thrown wide open and thoroughly ventilated just before going to bed. The temperature of the room should not be above 65° F. In the bed-room at night all the air coming into the room should come from the same side of the room, and the doors opposite should be closed. If the room is small, and the window is at the head or foot of the bed, some provision must be made to screen the bed, and to allow the air to enter the room without falling directly on the sleeper.

In the intense heat of summer, especially if the air is saturated with moisture, one sleeps much more com-

fortably on the side, with the face almost at the edge of the bed; in this way the formation of a stagnant pool of exhaled air about the face is prevented, which would otherwise be rebreathed, and greatly increase the feeling of discomfort and malaise.

On retiring at night the clothes worn during the day should be spread out over chairs to become thoroughly ventilated, instead of being hung up in a closed press or closet. From a sanitary point of view, it is essential that every article of clothing worn during the day should be removed at night. Both clothes and body need ventilation.

In the morning the clothes should all be taken off the bed, and they, as well as the night-clothes, should be spread out to be aired during the ventilation of the room. The windows are thrown wide open when one goes to breakfast.

The Care of the Nose, Throat, and Ears.—It will be most profitable to consider the care of the nose, throat, and ears together, since the mucous membrane lining these cavities is continuous, and so there is always great danger of an inflammation of one extending to the others.

It has been calculated that about one-third of our adult population are notably deaf in one or both ears. In the majority of cases deafness is the result of colds and throat troubles, and much can be done to prevent its occurrence.

The nose communicates through the nasal fossæ with the nasopharynx, and the mucous membrane lining the nose is continuous with that lining the throat.

The nose performs four important functions—it serves as a passageway for the air in breathing, and it warms, moistens, and filters the inspired air; it is the organ of smell; it aids in phonation; and it affords ventilation to the ears and accessory sinuses. But by far its most important function is the rôle which the nose plays in respiration. To supply the large amount of water necessary to moisten the inspired air, it has been calculated

that about one pint of water must be secreted by the nose daily; part of this amount of moisture is furnished by the tears. Mouth-breathing always causes dryness of the throat.

The filtration of the air is accomplished first through the action of the hairs at the external margin of the nose, which hinder the entrance of large particles, and, second, by the adherence of small particles to the moist surface of the intricate passages of the nose and nasopharynx. The microbes are expelled with the dust; in addition to this, the nose probably has the power of destroying any bacteria through the action of its germicidal mucus.

Obstruction of the Nasal Passages.—In adults the commonest modes of obstruction are the bending of the nasal septum to one side, or by a thickening of the septum by which one nostril may be completely closed up. The occlusion may also be due to the swelling of the mucous membrane or the presence of polypi.

In children the most common form of obstruction of the nose is by the adenoids and the enlargement of the tonsils; this enlargement may be so great as to prevent nasal breathing and interfere with the normal ventilation of the ears.

The Throat or Pharynx.—The throat or pharynx is the upper and funnel-like portion of the alimentary canal, which is seen at the back part of the mouth. It extends up back of the nose. The cavity of the throat is somewhat separated from that of the mouth by the soft palate. This is a membranous curtain, which is attached to the posterior part of the hard palate. The pendulous part of the soft palate is known as the uvula. The uvula sometimes becomes so greatly relaxed that it rests on the base of the tongue, which causes a constant irritation and slight cough, a condition which is easily relieved by a few astringent applications.

On looking into a mirror there will be seen, on either side of the throat, two arches, formed by folds of mucous membrane; these are known as the pillars of the throat.

Between these pillars, on either side, is an almond-shaped body called the tonsil. In health the tonsil should not protrude beyond the anterior pillar.

Causes of Diseases of the Nose and Throat.—Exposure to wet and cold, when insufficiently clad, or, even worse, sitting still with damp skirts or shoes on. A still more potent factor than exposure to cold is the relative degree of humidity of the atmosphere; great humidity is frequently accompanied by epidemics of influenza. Exposure to very high winds; sudden changes of temperature; the very dry air and the overheating of houses; insufficient covering at night; the inhalation of irritating vapors and finely divided mechanical irritants. Also, gastro-intestinal affections and uric acid.

Chronic enlargement of the tonsils predisposes to tonsillitis and to all the infective and contagious throat diseases. In addition, the breath is apt to be fetid, and swallowing the mucus, germs, and toxins has a deleterious effect on the stomach and general health. Mouth-breathing and anemia often follow, and there is an increased liability to inflammation of the eyes.

The Importance of a Healthy Condition of the Throat and Nose.—The nose and throat are the portals of entrance to the bronchial tubes and lungs, and it depends on the condition of their mucous membranes whether the germs of disease will find lodgment here and be carried down into the bronchial tubes and lungs, or whether they will be expelled with the mucus.

Any irritant which destroys the vitality of the epithelium covering the mucosa, or a local congestion which interferes with the nutrition, circulation, and secretions of the part, offers favorable conditions for the culture of bacteria normally present. Also, anything which will cause a lowering of the general health, and thereby lessen tissue resistance, acts as a predisposing cause to local inflammation, while the germs themselves excite inflammation by their active growth *in loco.*

From these facts will also be seen the importance of

having cut short, as rapidly as possible, any congestion or inflammatory troubles of the nose and throat.

Prevention of Nasal Catarrh and Sore Throat.—First in importance comes attention to the general health. Under this must be considered the clothing, food, ventilation, and exercise.

The clothing should be light, yet sufficiently warm to be a protection against the cold and winds. Heavy shoes with thick soles are necessary to protect the feet, and it is not so much the matter of getting wet as it is of sitting down with damp clothing on.

An atmosphere filled with dust in sweeping should not be tolerated in any well-kept house.

Local Treatment for the Prevention and Cure of Mild Cases of Nasal Catarrh and Sore Throat.—The treatment is practically the same. The toilet of the nose and throat should be made at least as often, and at the same time, as that of the teeth; certainly, the first thing on getting up in the morning and again before dressing for dinner. In our seaboard cities and towns, at least, there is a very general predisposition to some degree of congestion of the mucous membrane of the nose and throat. This means an abnormal amount of mucus which collects in the parts during sleep. Again, on coming in from out-of-doors on a windy day a large amount of dust, which means microbes as well, has become lodged in the mucous membranes of the nose and throat.

This toilet of the nose and throat is best carried out by means of a nasal spray. The spray apparatus consists of a bottle holding some two ounces, a hard-rubber spray piece, and a bulb with tubing to force the liquid through the spray piece. The tip of the spray should have the form of a cone; this should be introduced into each nostril, the bulb squeezed several times, until the amount of fluid is sufficient to be hawked out, and this process is facilitated by holding the mouth open during the spraying of the nostrils. After the nostrils have been thoroughly cleansed, the throat should be sprayed directly.

The liquids used must be bland and unirritating, and only enough should be used at one time to cleanse the parts. There are on the market excellent alkaline and antiseptic tablets; one tablet should be dissolved in a spray-bottle not quite full of water. This solution keeps in perfect condition, and is always ready for use.

A solution of boric acid, in the proportion of two teaspoonfuls of boric acid to one pint of water, may also be used.

If the nose and throat are inflamed, this so-called water spray should be followed by an oil spray, which will be found to be most soothing and healing. A separate apparatus for this will be necessary, as an oily solution would clog an ordinary water-spray, but the principle of the spray is the same, and it is used in the same way. The following is an excellent formula: Take of menthol and carbolic acid each two grains; of eucalyptol, six drops; and of albolene, two ounces. Mix well, and fill the spray-bottle one-third full; it is to be used in the full strength. Use only enough of this spray to moisten the nose and throat; by inhaling simultaneously with squeezing the bulb, the very fine spray is carried into the larynx, and so is very useful when there is an irritation of that organ, as shown by hoarseness. If there is only a slight irritation of the parts, the use of the spray twice daily will be sufficient; the last time should be just before retiring. On windy days it will be a great protection to the mucous membrane of the throat to use it just before going out-of-doors, on the throat only. If the inflammation is severe, the spray may be used as often as every two hours. This prescription should be put up by a good druggist.

Ear specialists condemn all nasal *douches* as dangerous, on account of the possibility of the water being forced into the Eustachian tubes.

General Treatment.—First of all, the system must be toned up by the systematic use of cold baths, adapted to each particular case, tonics, iron, and cod-liver oil. It is a grave mistake to allow these cases to become

chronic, as they may be the forerunners of influenza and even general tuberculosis. They need prompt and scientific treatment, which the physician alone is capable of giving.

The Ear.—The ear is divided into three parts—the external ear, the middle ear or tympanum, and the internal ear or labyrinth. The internal ear is the essential part of the organ of hearing in which the auditory nerve ends. Its structure is very complicated. The external ear is separated from the middle ear by the tympanic membrane or drumhead. This is a thin, small, membranous sheet, which is stretched tautly across the junction of these two cavities, and vibrates inward and outward between them. The external ear collects and conducts the waves of sound to the tympanum.

The middle ear, or tympanum, is an irregular cavity, situated within the bone. It is traversed by a chain of movable bones, which connect the drumhead with the internal ear, and serves to convey vibrations of sound to it. The middle ear, or drum cavity, is filled with air, and communicates with the pharynx by means of the Eustachian tube. The middle ear is lined throughout with mucous membrane, which is continuous with that of the throat and nose.

The Eustachian tube is continuous with the middle ear, and extends downward and forward about an inch to connect it with the pharynx, where it opens by a trumpet-like expansion, just above the soft palate, at the junction of the throat and nose. It serves to carry off the excess of fluid from the middle ear and to preserve the equilibrium of the pressure between the gaseous contents of this cavity and the atmosphere. The walls of the Eustachian tube are in close contact, but they are normally opened during every act of swallowing, yawning, etc., when the air finds its way into the middle ear. A stoppage of the nose reverses the process, and when the tubes are not likewise stopped up, every swallowing motion draws air out of the tubes. If the openings of the

tubes become closed, deafness, dizziness, and subjective noises will result.

The middle ear is the seat of about two-thirds of all aural troubles, and, since much of this could be prevented, this becomes a matter of great practical importance.

Causes of Impairment of Hearing.—The majority of the affections of the middle ear originate from extensions of catarrhal inflammations, from the nose and throat, through the Eustachian tubes. In children adenoids are the most frequent cause of deafness. The so-called hereditary deafness is probably due to an inherited configuration of the septum of the nose, a bending of the septum to one side, or a tendency to catarrhal affections of its mucous membranes.

Every cold in the head tends to mechanically involve the ears, and, while recovery may seem complete, there is likely to be some unrelieved trouble which insidiously but steadily increases—first one ear, and then the other, shows signs of defective hearing. If only one ear is involved, the condition may progress seriously before the patient is aware of the trouble.

Preventive Measures Against Deafness.—From what has been said, it naturally follows that the preventive measures must be chiefly those already given against taking cold. If one does take cold, instead of leaving it to run its course, as is too often done, proper therapeutic measures should be at once adopted to bring as speedy a cure as possible.

Impacted Ear-wax and its Removal.—A healthy ear should never show more than enough wax to render the hairs within soft, and the individual should be unconscious of the wax coming away. Wax does not collect in a healthy ear. When it does occur, there is a stopped-up feeling in the ears, due to the occlusion of the meatus by wax.

The only procedure that is safe to follow in order to remove the wax from the ear is to gently douche the ear with warm water, at a temperature from 105° to 110° F.

If this does not suffice, a physician must be consulted, as all efforts to remove the wax after it has become impacted are dangerous and futile except in skilled hands.

Earache.—The best thing for the relief of earache is the external application of heat by means of a hot-water bag. If this does not give relief, the ear may be douched with warm water. Earache can often be prevented, by those subject to it, by placing a very small piece of absorbent cotton in the ear before going out in very high winds or in automobiling.

Impediments to Normal Respiration.—These are, for the most part, acquired through improper habits of posture, dress, lack of muscular and chest development. Other impediments to respiration are a deviation of the septum of the nose to one side, marked curvature of the spine, and deformities of the chest which may be the results of rickets.

Curvature of the spine is frequently the result of muscular weakness, combined with faulty position at the desk.

The clothing must be sufficiently loose to admit of the fullest possible chest expansion; the measurements for the clothing, and most especially for corsets, must be taken during full chest expansion.

Heavy clothing suspended from the shoulders is also hurtful, because it renders impossible the expansion of the apices of the lungs. Obviously, all tight bands around the neck interfere with the respiratory movements.

Bodily position plays a very important part in maintaining the symmetric development of the chest and in the proper ventilation of the lungs; and this is a matter of the greatest importance to students, clerks, and writers who spend a great part of every day at the desk.

The faulty attitude, together with the weak muscles and the poor muscular development, are fruitful sources of spinal curvatures and flat chests; and free respiration is interfered with. Writing with a pen is most apt to be accompanied by a peculiarly cramped position of the body, rendering normal respiration impossible.

The Correct Attitude at the Desk.—The chair should be of such a height that the woman may rest her feet firmly and easily on the floor or upon a foot-rest, the seat being deep enough from before backward to accommodate about three-fourths of the length of the thighs, while the back of the chair should be so curved as to support the spine easily in its natural curves, both at the waist and at the level of the shoulder-blades.

The chair and desk should be sufficiently close together so that the student may sit erect to read from books, since leaning forward at the desk causes round shoulders, flat chest, and short-sightedness. When the desk and chair are properly arranged, two-thirds of the forearm can be rested upon the desk without raising the shoulders.

In reading, the distance of the book from the eyes should be twelve inches, and the book-rest should be inclined, sloping downward toward the reader, at about an angle of 85 degrees.

If the woman has any great amount of writing to do, she should learn to use a typewriter. In using this machine she not only writes very much more rapidly and easily, but the position of the body is much more erect than that assumed when using the pen, and it is not nearly so fatiguing to the muscles of the hands and arms.

All closely confining sedentary occupations, as writing, sewing, etc., should be frequently interrupted to move about for a few minutes, rest the eyes, and take a few deep breathing exercises before an open window; this is necessary for the eyes as well as for the ventilation of the lungs.

Ventilation of the Lungs and Breathing Exercises.—Forced respiration is essential to completely change the air in the lungs, to maintain the elasticity of the lung tissue, and to expand the chest in every direction. Only in this way can a thorough ventilation of the lungs take place; a full supply of oxygen is taken in, which stirs up, disinfects, and cools the stagnant residual air, and

forced expiration expels the respiratory excretions. One of the frequent causes of foul breath is lack of ventilation of the lungs, so that the expired air becomes laden with impurities.

In normal breathing the current of air which passes in and out of the lungs travels through the nose, not the mouth. The ingoing air, by exposure to the vascular mucous membrane of the narrow and winding nasal passages, is warmed and moistened, and at the same time the mouth is protected from the desiccating effects of the continual inroad of comparatively dry air.

By means of respiratory exercises the mobility of the chest may be greatly augmented; there is an increased flexibility of the ribs and sternum, as well as loosening of the thoracic joints, which may have become stiff, and these exercises also lead to a development of the respiratory muscles.

In this manner only can the frame work of the chest become thoroughly inflated from within, and thus all parts of the lungs, which run the risk of becoming incapacitated from lack of use, be brought into play.

It is highly important that this thorough ventilation of the lungs should take place at least three times a day—the first thing in the morning, while making the toilet, again about the middle of the day, and at night just before retiring.

To obtain the greatest benefit from these exercises they must be taken without corsets, the clothing must be light and loose, and the body lightly clad. The air in the room must be fresh, and after they have been learned, they can, as a rule, be taken before an open window. In the morning they are best taken just after the cold bath, when, by removing the impurities and filling the lungs with fresh air, and at the same time starting up a good vigorous circulation, they cause one to begin the day with energy and zest.

The respiratory movements are diminished during sleep, and at the same time there is a large accumulation

of blood in the splanchnic veins, so that, particularly when there is any tendency to difficulty with the breathing at night, the trouble is greatly lessened by filling the lungs with pure air just before retiring.

It is necessary, first of all, to learn the art of breathing, to be able to dissociate the clavicular, the costal, and the diaphragmatic. By clavicular breathing is meant the raising of the collar-bone and shoulders as high as possible by means of a slow but deep inspiration—this expands the apices of the lungs; costal breathing is the throwing out and expanding the chest to its utmost capacity, and so enlarging the chest in its transverse and anteroposterior diameters; diaphragmatic breathing is the depression of the diaphragm and the protrusion of the abdomen without raising the lower ribs. The last is the most readily learned in the supine position; the bed supports the weight of the body, so that the individual is able to concentrate her entire attention on fixing the bony thorax, depressing the diaphragm, and protruding the abdomen at every inspiration and retracting it to the utmost with every expiration. This, of course, develops and gives tone to the abdominal muscles.

When the woman has conquered these first principles of respiration, she is ready to put them into practice in the standing posture. They should be learned before a mirror, and after that taken before an open window. The hands should be placed on the hips; first elevating the collar-bones and the shoulders to the utmost, while still holding the breath, she expands the chest, always breathing in from above downward, and, lastly, the diaphragm is depressed. With the lungs thus expanded to their utmost capacity, the breath is held as long as possible, then the lungs are emptied by an abrupt and forced expiration.

These exercises should be repeated at first ten times, gradually increasing to thirty times. It is well to take one or two ordinary respirations between the forced ones.

It will be found that, as these exercises proceed and the lungs are filled with purer air, the breath can be held for a longer period of time, and that with practice the length of time that the breath can be held is greatly increased; it should be held for half a minute. Public speakers, singers, and divers are all skilful in this respect.

When these simple breathing exercises have been mastered, breathing exercises can be combined with other exercises, which have as their aim the development of the muscles of the chest.

Reading aloud, singing, talking, laughing, are all good exercises for developing the capacity of the lungs.

The Cure of Chronic Bronchitis by Deep-breathing Exercises.—The upper part of the body must be nude and the exercises taken before a mirror, so that the woman can watch the movements of the chest and abdomen, see that all the hollows of the chest are filled out during forced inspiration, and that the muscles of the abdomen are properly retracted. For the average woman this last will be the most difficult; in beginning these exercises she will find that it will require all her concentrated energy and will power to cause a retraction of these disused muscles.

Patients with chronic bronchitis do not have the ability to perform forced respiration properly. The respirations are too superficial, and the respiratory movements are not properly performed.

As respiration is ordinarily performed, the partial expansion of the upper part of the chest is accompanied by a contraction of the abdominal muscles, whereby the diaphragm is forced upward, with the result that the lower part of the lungs remains very slightly expanded, whereby the circulation as well as the removal of mucus is imperfectly performed. This lack of forced respiration is a frequent cause of acute bronchitis running into a chronic form.

In chronic bronchitis it is especially in the lower part of the lungs that stagnation of the secretions takes place,

and they can only be dislodged from the mucous membrane by forced abdominal expiration and the ascent of the diaphragm. This causes a cough which expels the mucus, and forcible abdominal expiration and cough are the only means of drainage of the lower and deep-seated parts of the lungs. Further, in forced respiration the muscle tissue of the bronchial tubes contracts, which certainly does not take place in ordinary respiration, but, on the contrary, this tissue atrophies.

Other beneficial results from forced respiration are increased oxygenation, improved nutrition, changes of a mechanical nature, ventilation, and disinfection of the lungs, massage of the lungs and pleura, and drainage.

No other method of treatment is so successful in the cure of chronic bronchitis not dependent on disease of the nose and throat. In from two to six weeks of treatment, in which there is a profuse discharge of mucus, it will be found that the bronchial tubes have cleared up, provided that the patient is supplied with an abundant supply of fresh air day and night. Methodically practised, deep breathing is not only the surest cure, but also the safest stimulating expectorant.

Relation of Colds and Influenza to Pneumonia and Tuberculosis and their Prevention.—We have already seen that bacilli are not only the cause of acute infections, but also of chronic bronchitis, and that this was especially true of the bacillus of influenza and the pneumococcus of pneumonia.

It is well known that influenza is an infectious disease, which rapidly spreads through the family and the community, but it is not so well known that the so-called "common colds," ordinary sore throat, and tonsillitis are also highly contagious. The infection is carried from one person to another by direct contagion; the air is being constantly sprayed with the germs of disease in talking, laughing, sneezing, and coughing. In coughing and sneezing it is not sufficient to hold the hand before the mouth—a handkerchief must be used for this purpose.

Colds are among the most frequent of the so-called minor ailments in this country. The causes are the over-heating of the houses, the great dryness of the air, badly ventilated houses and public assembly rooms, which render people very susceptible to the great variations in temperature.

Prophylaxis, or *the prevention of colds,* combine all those measures which promote the general tone of the system, and may be said to embrace all the elements of personal hygiene. Good digestion and proper nourishment of the body with suitable food; the proper ventilation of houses, all public buildings and conveyances, for in these latter the public are brought into very close contact with their fellow-men.

Local prophylaxis would consist in the toilet of the nose and throat—the removing of adenoids and enlarged tonsils.

The individual must remember that she can reinfect herself; for this reason, an abundant supply of hand-kerchiefs must be used; they should be placed in a handkerchief bag and washed separately. Packs of cards should be thrown away before they become soiled. Sprays and atomizers must be individual property, and be kept thoroughly cleansed.

With the exception of deep-seated chest colds, in the early stages a cold may often be nipped in the bud by a few hours of hard sudorific work in the open air. In half a day the nasal ducts and respiratory system will throw off irritating matter that would take much longer time if the patient remained indoors and relied on the action of drugs alone.

Treatment.—Other methods of treatment are a hot tub-bath on retiring, an active but not too severe cathartic, as two grains of calomel, taken just before going to bed, and, if the individual is chilly, a hot lemonade should be taken at the same time. Both the cathartic and the free perspiration will aid in relieving the internal con-gestion and thus aid in its abortion. A cold sponge

should be taken the following morning to tone up the system. Turkish baths are also useful in breaking up colds; again, the precaution must be taken to avoid chilling on leaving the bath.

The following tablet is a very simple and very efficacious remedy for breaking up a cold in the early stages: Take of powdered camphor $\frac{1}{4}$ gr.; of the sulphate of quinin $\frac{1}{4}$ gr.; and of the fluidextract of belladonna root $\frac{1}{8}$ minim. This should be well mixed, and made up into one tablet or a capsule. One tablet is taken every half-hour, until four doses have been taken; after that one tablet every three hours, until the running of the nose has ceased, which generally occurs within twenty-four hours. If there is not marked improvement at the end of this time, or if there is any fever, a physician should be consulted at once.

Quinin, when given alone to abort colds, must be given in sufficiently large doses to produce cinchonism, the subjective symptom of which is a slight deafness or ringing of the ears. The natural tendency of cold is to cause inflammation of the middle ear, and since the use of quinin in large doses causes a congestion, and so predisposes to inflammation of the middle ear, its use should be avoided.

The great amount of illness and mortality from pneumonia during and following epidemics of influenza is too familiar to the public to need more than mentioning. The patient is so rapidly and extremely prostrated by the attack of influenza as to be susceptible to the ready action of the pneumococcus, which, as we have seen, is ever present, and the extension of the inflammation from the fine bronchial tubes to the air-cells of the lungs rapidly takes place. In the exhausted condition of the patient she is not able to resist this invasion, the heart is already weakened, and death frequently rapidly ensues as the immediate result of heart failure.

The Prevention of Tuberculosis.—The tubercle bacillus is practically ubiquitous, and the prevalence of

tuberculosis is universal. Hence it is imperative to raise the resistance of the individual in every way possible, as well as to limit the spread of the infection. This means the employment of all the resources of public and personal hygiene, public and private sanitation, and the education of the public in how the disease is disseminated, and how its spread may be prevented; also the teaching of the individual, her duty to the family and society, as well as to herself, in order not to spread the contagion.

Tuberculosis attacks the crippled and poorly developed lung just as surely as it shuns the one which is fully expanded and in constant and active service. Numerous observations have established the existence of a constant ratio between tuberculosis of the lungs and deficient chest expansion.

Diet.—The doctrine has been growing among the laity that the child's likes and dislikes should determine what food it should eat. Thus a finical taste is cultivated and a lack of proper nourishment follows, and it is this finical diet class of people which forms a large percentage of tuberculous invalids. It has long been recognized that a proper diet and the tolerance of it is of the utmost importance in the treatment of tuberculous patients, but from the foregoing it would appear that a proper diet throughout life is also of the utmost importance in the prevention of disease; a sufficiency, not only as to quantity, but also as regards variety.

It is the patient who can eat everything who stands a good chance of getting well. So, too, it is the individual whose diet for years has been perverse, who could not eat meat, to whom eggs were distasteful, who could not stand milk, who was infected with the vegetarian fad, or the two-meal-a-day fad, who stands a fair chance of falling a victim to tuberculosis, through a lowered tone of the system, because it offers but a feeble resistance to a powerful and insidious enemy. And the mode of the preparation of the food is an equally important factor. It has been shown that the poor cooking among the lower

classes is a powerful predisposing cause to intemperance and tuberculosis.

Influenza is a frequent and important agent in bringing to light latent tuberculosis, and must be classed as an important exciting if not predisposing cause. Low, damp climates predispose to the infection by lowering the vitality. Tuberculosis is more prevalent in cities than in rural communities, due to the manner of housing and the character of the occupation.

Summary of the Present Views of Infection.—The doctrine of inherited and acquired susceptibility still holds sway; next, that all infants are susceptible, and that susceptibility lessens with increase in age; that adults are comparatively insusceptible when free from general and local lowered resistance and repeated and prolonged exposure.

As to the source of infection, the consensus of opinion and ascertained facts point to the sputum as of overwhelming importance; cow's milk is an important factor; the food may be infected directly by coughing, or the dirt and dust from the floor and hands; the fingers and many other objects that find their way into the child's mouth are sources of danger. To adults, both dust and moist droplets are more often the source of infection than infected food.

Expectoration.—Careless expectoration is the chief source of infection. Laws should be passed and enforced prohibiting the expectoration on pavements, stairways, in all public conveyances, and all public places.

The danger of infection from tuberculous house servants has not been sufficiently appreciated. A chronic cough in the case of a servant should be at once investigated by the family physician. Servants should be taught the necessity for washing the hands before touching the food or cooking utensils. The condition of their rooms, clothing, bathing, and other personal habits should be closely investigated, and personal cleanliness should be demanded as a *sine qua non* for obtaining or keeping a situation.

Since it is a well-known fact that tuberculosis can be acquired from the occupation of houses and rooms formerly occupied by tuberculosis patients, it has been suggested that a clean bill of health should be demanded of the owner of the house before renting it; that is, a certificate from the Board of Health, that no case of infection has existed in the house, or that it has been properly disinfected since that time. If such a movement became popular, landlords would be obliged to furnish these bills of health in self-defense. Since the Boards of Health demand the reporting of all cases of tuberculosis, this scheme is by no means impracticable or Utopian.

The tubercle bacillus is not destroyed by any degree of cold, but both light and sunlight are distinctly injurious to these bacteria. The lowest fatal temperature to the tubercle bacillus is 131° F. of moist heat, acting for a period of six hours. The thermal death-point of tubercle bacilli in milk is of great practical importance, and many experiments have been made which have determined that a temperature of from 140° to 167° F., was sufficient if continued for one hour. If it is desired to pasteurize the milk, it should be placed in a closed bottle or stirred and heated for at least twenty minutes at a temperature of 149° F.

Disinfection.—The use of formaldehyd gas has practically displaced the use of sulphur for the fumigation of rooms, as well as for the disinfection of furniture and clothing. For this purpose a moist vapor used in a sealed room is essential.

At least 8 ounces of the commercial 40 per cent. formalin should be used for each 1000 cubic feet of air content. The most efficient method is that used by Biggs, of New York, which is as follows: For an ordinary room, 1000 cubic feet, 1 pound of lime, 8 fluidounces of formalin, and from 2½ to 3 fluidounces of commercial sulphuric acid are required. All openings but the door are sealed. The formalin is poured into an empty water-pitcher, 4 ounces

of water are added, and then the sulphuric acid is poured slowly in. The lime is placed in a china or earthenware wash-basin on the floor upon newspapers; all water is removed from the room. All drawers and cupboards opened; the mattresses stood on end; and the mixture poured quickly upon the lime, when the door is sealed. The sulphuric acid may be packed in a tin bucket containing the lime, and, with the formalin in a separate bottle, may be used by any person of ordinary intelligence. The room should remain closed from twelve to eighteen hours. It must not be lost sight of that after disinfection by means of formalin a thorough cleansing is imperative. A room which has been thoroughly cleaned and carbolized is safer than a room which has been disinfected with formalin and not properly cleaned.

After death or removal the entire place should be renovated. Besides disinfection and scrubbing the painted woodwork with a solution of hot soda water, the walls should be repainted or repapered, and the woodword repainted.

Rugs, bedding, pillows, and clothing should be disinfected by hanging up in the room while it is undergoing disinfection. Books and all articles of small value should be burned. All soiled linen should be boiled.

The Kidneys and their Function.—The kidneys are the secretory organs of the urine; they are two in number, and are the largest tubular glands in the body. They are deeply seated in the lumbar region, lying one on each side of the vertebral column; the kidneys extend from the eleventh rib nearly to the crest of the pelvis. They are usually embedded in a considerable quantity of fat, which is the chief factor in holding them in position, aided to some extent by the large blood-vessels with which they are connected. The kidneys are oblong bodies and measure about 4 inches in length, 2½ inches in breadth, and over 1 inch in thickness. Their weight is about 4½ ounces.

As an excretory organ the kidney probably stands

second to the alimentary canal; it surpasses in importance the skin, whose total excretion of water it equals. The abnormal substances appearing in the urine are often not the products of disease of the kidneys, but of some other organ or system.

The kidneys excrete and put the finishing touches upon the urinary fluid; they act at the end of the metabolic course, both as active and as passive agents. While to some extent the kidneys are mechanical contrivances, mere filters, so to speak, they are to a far greater degree active, specific glands. The renal epithelium has the power of synthesis, and builds up complex substances that are not apparent as such in the blood or lymph, as well as the power of analysis or breaking down of substances. These changes are due to the formation in the tubular cell of an enzyme, which we call histozyme. The kidney is the end link in the vascular chain, and the daily performance of healthy kidneys is no doubt a combination of the mechanical and the vital processes.

The Secretion of the Urine.—In a perfectly normal being the problems of waste and repair are balanced to a nicety. As we know, the tissues of the body are bathed in lymph containing in solution the compounds that are necessary for their nourishment—proteids, carbohydrates, fats, salts, and gases. Waste follows in direct proportion to the activity of the tissues. The worn-out, effete material first finds its way into the lymph, and from it into the blood-stream, to be later eliminated from the economy, else deleterious results will follow their retention in the body. It is by the selective action of the cells of the various glands of the body that these useless substances are removed from the blood, and converted into such forms as can be readily excreted. In the main, the products to be removed are urea and the allied nitrogenous bodies—carbon dioxid, salts, and water. These organs are of vital importance, since nearly all of the waste-products containing nitrogen are eliminated in the urine.

The most easily understood function of the kidneys

is the excretion of the urinary water; this varies in amount with the rapidity of flow through the renal vessels and to some extent on the blood-pressure.

The separation of the solid substances of the urine form the next function of the kidneys, and these substances

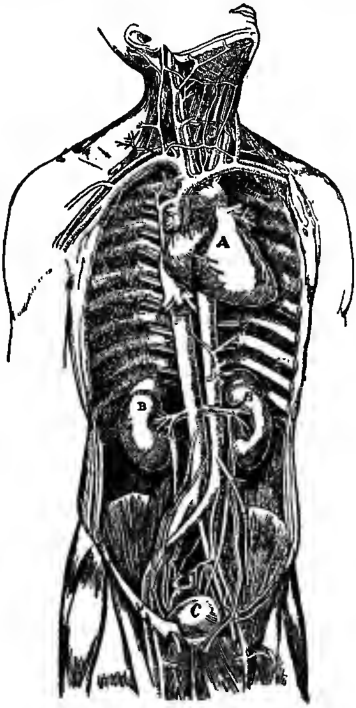


Fig. 11.—Relation of kidneys to heart and great blood-vessels: A, Heart; B, B, kidneys; C, bladder (after Quain).

fall into two groups—inherently useful materials, which are in excess or which have served their purpose, and substances which are inherently harmful. The latter class embrace many end-products of metabolism, which we are accustomed to consider as normal constituents of the urine.

The analytic study of the urine is of great value to the physician and surgeon, because of the knowledge which it gives concerning the processes of metabolism occurring within the body. The nature and amounts of the various end-products of metabolism are carefully investigated as they occur in the urine, whether they be normal or pathologic.

The Urine.—The normal human urine recently passed is a clear liquid, of a straw color, with an average specific gravity of 1020, the specific gravity indicating the amount of solids contained in the urine. It is acid in reaction. The quantity for twenty-four hours is 50 ounces, or about 3 pints, depending on the amount of water ingested. During sleep the amount secreted is less than at other times. The amount of urine is decreased after profuse sweating, diarrhea, thirst, diminution in the blood-pressure, and after severe hemorrhage. When the body temperature is considerably higher than normal, the amount of urine is again diminished in quantity.

Urea forms nearly one-half of the solids in normal urine and nearly one-half of the urea is nitrogen. It is the principal representative of the waste of the nitrogenous tissues. The chief source of urea is from the metabolism of the muscles; the ingestion of a large amount of proteid food stimulates metabolism. The quantity of urea passed in the twenty-four hours is about 500 grains.

The uric-acid constituent is very small, and in the human urine scarcely reaches 0.03 per cent. of the solids. Lack of exercise leads to an increased formation of uric acid by a lessening of the oxidation of the tissues. In gout the amount of uric acid excreted is abnormally small, because it accumulates in the blood and tissues. The brick-dust deposit sometimes seen in the urine is composed chiefly of the urate of sodium. The average daily amount of uric acid passed in the human urine is about 7 grains. The excretion of uric acid may be increased by drinking copious drafts of water.

Toxicity of the Urine.—After the removal of both kid-

neys the animal dies of uremia; that is, there is an accumulation of urinary products in the blood. The removal of one kidney is not necessarily fatal, and women have so lived very comfortably for many years. A human being excretes enough poisonous material by the kidneys in two days to cause death.

The Urinary Excretory Apparatus.—After the urine has been secreted by the kidneys it must be carried away from the body, so that the economy may not suffer from the resorption of the contained toxic principles. The excretory apparatus comprises the ureters, the bladder, and the urethra.

The ureters are two cylindric tubes of the diameter of a goose-quill and about 15 inches long. They make their exit from the inner border of the kidney, and pass downward and inward toward the median line, to empty into the base of the bladder by a slit-like orifice.

The bladder is the reservoir for the urine. It is a musculomembranous sac, situated in the pelvis, and in the female it is in front of the uterus and above the vagina. It normally contains one pint. It should be emptied four times a day. If it is allowed to go longer than this, it becomes overdistended, and is apt to displace the uterus backward, and the bladder-walls themselves become weakened.

The Physiology of the Female Generative Organs.—The internal and essential organs of generation are the uterus, ovaries, and the Fallopian tubes. These organs have to do with the process of ovulation, menstruation, and reproduction.

The Ovaries.—These are two small bodies of an almond shape, and lie one on either side of the uterus. The bulk of the organ consists of connective tissue, in which lie embedded the Graafian follicles, or ovisacs, in which the ova are contained.

During the child-bearing period, or from about the age of fifteen to forty-five years, the development of the Graafian follicles and the discharge of the ova are con-

tinually taking place. The liberation of the ova usually takes place at definite times, which, in general, coincide with the menstrual epochs, one or more ova being set free at each period, but this is by no means invariable.

The Uterus.—The virgin uterus is a small, hollow, muscular organ, somewhat pear shaped, whose cavity is about 1½ inches deep. The uterus is situated in the middle of the pelvic cavity, between the bladder and the lower bowel. It is held in position by broad elastic bands, which go to different sides of the pelvis; it is also in part supported by the structures below and above it; but so loosely is the uterus held that it is easily pushed about, as, for instance, by a full bladder or a packed bowel, and persistently allowing the bladder to become overful, and failure to have a daily evacuation of the bowels, are prolific sources of displacements of the womb.

Respiratory Movements of the Uterus.—When no constrictions are placed about the waist, the uterus moves freely up and down with every respiration. So distinctly, and with such regularity, do these movements occur that an operator, by watching the movements of the uterus, can tell the effect that the anesthetic is having on the patient's breathing. These so-called respiratory movements play a very important rôle in the circulation of the uterus, and in the return of the venous blood to the heart.

Anything which interferes with these movements, as the wearing of corsets or of tight bands about the waist, prevents the free return of the venous blood. The uterus becomes congested, and through the constant abnormal weight of the organ itself, as well as by the pressing down upon it from above of the superincumbent organs, the uterus is pushed down below its normal position, the ligaments whose duty it is to hold it up become relaxed, and the unhappy woman suffers all the agonies that are attendant on the "falling of the womb." For this reason the disorder is frequently met with in women who have never borne children as well as in those who have.

The Functions of the Uterus.—The function of the

uterus is to provide a favorable place for the reception of the product of conception, where it may be protected and nourished during the period of its development. The purpose of menstruation is to keep the uterus in suitable condition for the reception of this product of conception at any time. It is now known that the menstrual flow is not the whole of menstruation, and that the changes going on in the uterus are almost as continuous as the process of digestion.

Average Duration of the Menstrual Flow.—The average duration of the menstrual flow is five days, although the variations are considerable in healthy women. A flow lasting any place from two to six days is perfectly consistent with health, but a flow continuing less than two days or more than six days generally indicates a local or general disease.

Character of the Menstrual Flow.—For the first few hours, or perhaps for the first day, the flow is usually slight in quantity and light in color; on the second and third day the flow reaches its height, and is profuse and dark in color, but it should never be clotted; after this it generally ceases. The amount of the flow varies from 5 to 10 ounces. If less than 5 or 6, or more than 18 napkins, are pretty well saturated through, the amount may be considered abnormal.

Premonitory Symptoms of the Flow.—The premonitory symptoms of the monthly flow should not be so marked as to cause the individual any discomfort. The first indication of the return of the period should be the flow. There is generally a feeling of abdominal fulness, with some lassitude and sometimes slight headache. The temperature is lower and the pulse is slower than at other times. This lowered tone of the system is an additional reason for increased care against exposure in wet or cold weather.

Hygiene of Menstruation.—During the menstrual period all *cold* baths must be strictly prohibited, whether tub-baths or cold sponges. The reason for this is that the

application of cold to the surface causes a driving in of the blood from the exterior of the body to the internal organs, and, at the time of the menstrual periods, there is already a congested condition of the pelvic organs, and it must be remembered that congestion is the first stage of inflammation.

Hot or warm sponge baths may be taken throughout the period, and the vulva should be bathed with warm water twice a day throughout the entire period of the flow, as this not only removes the clotted blood before it decomposes and becomes the source of irritation, but also removes other irritating matters, and prevents the nervousness that is caused by local irritation.

Another question which is still *sub judice* is the necessity for and the frequency with which vaginal douches should be taken; all physicians are agreed that a vaginal douche, taken immediately after the menstrual period, is beneficial, as it removes all of the débris of the flow, which is sometimes very irritating.

Exercise.—A moderate amount of exercise should be taken every day; this is needed now quite as much as at any other time, and only good can result from it, and no harm comes of a woman going out in the rain or the cold weather. As has been shown, the menstrual process is going on for a large part of the time, and the flow is only the external appearance, but during the time of the flow the woman must be unusually careful not to get her feet wet or sit down with damp clothing on. Violent exercise of all kinds is to be prohibited at this time, as dancing, bicycling, gymnastics, and walks of over three miles. The reason for this is very obvious: the uterus has now reached the height of its turgescence, and is heavier than at any other time, hence the danger that displacements or a very profuse flow would be caused by any kind of violent exercise.

Treatment.—If the woman has been so unfortunate as to have been caught out in a heavy rain, so that her clothes have been wet through, or if in the cold weather

she should come into the house thoroughly chilled, the best thing to do is to take off her wet things as quickly as possible; be well rubbed down with hot rough towels; drink a cup of hot tea, and go to bed at once, with a hot-water bag placed over the abdomen or under the small of the back. She should remain in bed until the next morning, to the end that the circulation may regain its equilibrium as quickly as possible by the immediate relief of the pelvic congestion.

If this exposure should have caused the sudden cessation of the flow, a hot mustard foot-bath should be taken. One tablespoonful of ground mustard is used to the gallon of water, as hot as it can be borne; the pail should be made as nearly full as possible, without running over, and a blanket wrapped about the pail and woman, so as to cause a profuse perspiration; this should be kept up for ten minutes; as the water cools off, hot water may be added.

Profuse menstruation, painful menstruation, and scanty, very slight, or irregular flow are all abnormal conditions that are due to some abnormal or pathologic causes, and a good gynecologist should be at once consulted, so that not only suffering may be prevented, but that serious consequences to the general health may be averted.

CHAPTER VI

THE NERVOUS SYSTEM AS THE BALANCE OF POWER IN THE BODY

The Brain the Master Organ of the Body; the Functions of the Brain; Habit and Automatism; the Physiology of the Brain and Nervous System; the Hygiene of Work; the Toxins of Fatigue; Overwork; Signs of Overwork; Nature's Restoratives; Avocation; the Physiologic Necessity for Laughter; Vacations and Health; Sleep; Insomnia.

The Eyes; Eye-strain; Description of the Visual Apparatus; Optical Defects and Their Correction; the Mechanism of Eye-strain; Local Symptoms of Eye-strain; Artificial Lighting; Hygienic Precautions in Reading and Sewing; Injuries to the Eyes; Symptoms and Treatment of Conjunctivitis; Trachoma; Styes.

Functional Nervous Disorders, Headache; Neurasthenia.

The Brain the Master Organ of the Body.—The brain is not only the most important organ in the body, but its essential organ, for the sake of which all the other organs and tissues exist, and it is the master of the whole. It not only receives help from every other organ, but it also largely controls the working of each. By its mental action alone it can hurry the heart's beat or slow its pace; it can make the skin shrivel or flush; it can quicken or stop digestion; it can stop or change the character of all secretions; it can arrest or improve the general nutrition. Every organ and every vital process is represented in the structure of the brain, by special centers and groups of cells that have a direct relation with such organs and processes, and through which they are controlled.

The Functions of the Brain.—The brain may be said to have four chief functions; the first is that of motion; it presides over and stimulates all the voluntary muscular movements of the body, regulating their force, and co-ordinating in their working the different groups of muscles

needed to perform them. Mind and muscular movement have the closest possible connection with each other. The second function of the brain is that of feeling and sensation; the third is that of nutrition; through this its own nourishment and that of the rest of the body is regulated. While mind is the fourth and highest form of nerve force, it is not created in the brain, but is absolutely conditioned by that organ.

Different groups of brain-cells have different work assigned them; some have motion, some have sensation, some have nutrition, and some have mind. For example, special tracts of brain govern inhibition. While every group does its own work, it is related to and combined with others, influencing them, and being influenced by them.

Every kind of mental activity uses up the brain energy of the cells. To think clearly, plenty of healthy blood must be supplied to the cells. In order to make healthy blood, there must be an abundance of fresh air supplied to the lungs, and a vigorous heart to pump it up to the brain. It has been demonstrated that, during intellectual work or emotional feeling, there is an increased supply of blood to the brain, which may become more or less congested, and that there is an actual rise of temperature; whereas during periods of relaxation, rest, or fatigue, the brain is pale and anemic.

The brain-cells generally, but particularly those cells involved in mental activity, are of such a nature and constitution that they cannot rest absolutely during the waking hours. They may act slowly or with great rapidity; different brains have different capacities for energizing, both in regard to speed and force; and, further, the brain may be pushed to work greatly in excess of its normal activity, just as an engine may be allowed to go at the rate of 50 or 60 miles an hour, or may be pushed to go at the rate of 100 miles an hour. In both cases the danger resulting from speeding are greatly in excess of going at the normal rate of speed.

In any case, the continuous brain action implies the necessity for continuous repair. The only complete physiologic rest which the brain enjoys is during sleep, when the process of repair goes on most rapidly; during this period the brain-cells absorb their nourishment from the blood in excess of their needs, and so lay up a store of energy for the waking hours.

Habit and Automatism.—It is one of the innate qualities of every tissue and of every organ in the body, that when any vital action is performed, any vital process gone through with, it is easier to do it the second time, and the continuous exercise of the action makes the performances more and more easy, until they become automatic.

The physiologic basis of habits consists of the plasticity of the nerve substance, and in the capacity of nerve substance to receive and retain impressions. There results the certainty that the nervous system will act again more easily in those ways in which it has already acted.

On the one hand, the automatic performance of work saves an enormous amount of brain energy; on the other hand, bad habits may be formed whose effects may be most pernicious, and which are gotten rid of only with the greatest difficulty. An example of the first is the young child learning to walk; at first he accomplishes the feat only by the fixed concentration of every power of the brain on the act; whereas the healthy adult walks automatically, without paying the least regard to the movements or the manner in which they are accomplished. Hysteria and ungovernable outbursts of passion furnish good examples of the bad habits that may be formed, owing to the lack of discipline and the powers of inhibition; every time that a woman gives way to one of these outbursts, so much the harder will it be for her to prevent or control another outbreak. Inhibition is the highest and most important function of the brain.

Habits woman must have, but it is for her to choose what they shall be, provided she chooses quickly; the

time limit in habits is one of the strong evidences of the close connection of body and mind. It is a startling fact to face, that a woman's habits are largely fixed before she is twenty; that the chief lines of her future growth and acquaintance before she is twenty-five; and her professional habits before she is thirty; yet to something like this James believes that physiologic psychology points. The woman becomes a bundle of habits, and her habits settle about her like a plaster cast.

The Physiology of the Brain and Nervous System.—The brain, spinal cord, and spinal nerves constitute the so-called cerebrospinal nervous system. The brain is that portion of the nervous system which is contained within the cranial cavity and which it completely fills. The spinal cord is the continuation downward, from the brain through the spinal canal, of nerve substances, and from which the spinal nerves are given off. The nerves may be described as cords and threads of varying degrees of fineness, distributed to every tissue and organ in the body.

The nervous system has been likened to the electric telegraph, the brain being the central station, while, in addition to the special senses, the body is provided with numerous terminal substations in the skin and internal organs of the body, which keep the brain informed of what is going on in the world around it, as well as in the various parts of the body. The nerves simply act as conductors to transmit the messages. The body is supplied with two distinct sets of nerves or wires, one of which carries messages from the outside world and various organs to the brain, while the other set transmits orders from the brain.

The spinal cord is the center of reflex acts; that is, if the leg of a brainless frog is touched with acid, he will take the other leg to wipe it off with. There are, as we have seen, substations in the skin, hence the acid causes the sensation of a foreign body, word is telegraphed the spinal cord, where there is a large central station;

from here word is sent out by another set of nerves, to move the leg away from the acid, but this being insufficient, word is telegraphed to the other leg to wipe off the offending substance. Did the same thing happen in the body, at the same time that the cord telegraphed word to the affected member to withdraw it, it would telegraph the brain, and the sensation of pain would be felt.

A message travels along a nerve at the rate of about thirty-six yards a second, or a mile a minute. This is about the time made by a lightning express train. The distance in the body being so short, the time taken is imperceptible, and we say that movement is instantaneous.

The paths traveled by nerve impulses are made passable by use; the oftener an impulse traverses a given route, the more adapted such a route becomes for future traffic.

But all of this has to do with the nerves which are under the control of the will. There is another set of telegraph wires in the body, called the sympathetic or vegetative system, so-called because it presides over the processes of nutrition and is beyond the control of the will.

The Hygiene of Work.—Since the motor centers are located in the brain, it is natural to expect that all definitely directed movements will directly affect the brain and the mental development, and so it is. Du Bois Réymond says that it is easy to demonstrate that such bodily exercises as gymnastics, fencing, swimming, riding, dancing, and skating are much more exercises of the central nervous system, of the brain, and spinal cord than of the muscles.

It is further urged that healthful energy of will is impossible without strong muscles, which are its organs, and that endurance, self-control, and great achievement all depend on muscle habits.

The philosophy of work consists in its necessity. The brain-cell in health cannot cease to be active, except to a partial extent during sleep. There must be some output

of mind from the mind cell and of motor stimulus from the motor cell. The proper selection of work for that particular brain to do, and the physiologic regulations of the work done, is the basis of the hygiene of work. For health, for happiness, and for efficiency, right work rightly done is the most important matter in any man's or any woman's life.

The physiologic, as well as the moral necessity, has always been conceded for every man to have a life-work—a vocation; a work for which he should be fitted, and for which he was capable, sufficiently congenial not to sink into mere drudgery, and which would, at the same time, afford ample financial compensation to be remunerative and a stimulus to his power of endurance.

Important, from a physiologic point of view, as a vocation is for men, it is equally or even more important for women. It is highly probable that the unstable nervous system of women and their emotional extravagance and dissipations, whether of frivolity, wickedness, or grief, is largely due to lack of mental discipline and muscular development. It is a psychologic proposition that any woman who has a toothache suffers less if she keeps busy, and any one will testify that she suffers much less from the intense heat of summer if she is busily employed.

One of the great objects of a definite and fixed occupation is to turn the thoughts out from the ego. Work of some kind is indispensable to the health and happiness of every one, since it necessitates an objective instead of a subjective attitude of mind.

Experience teaches that the brain, like the muscles, is subject to training; occasional excessive efforts, with long intervals of repose, are rather injurious, while a many-sided activity, constantly repeated, interrupted by sufficient shorter rests and supported by sufficient nutrition, is strengthening. A healthy training of the brain should be as many sided as possible.

Symmetric development and training of every func-

tion of the brain is as essential for mental efficiency and sanity as the development of all the muscles of the body is for bodily vigor, and a one-sided training of the mental powers is as certain to produce eccentricities of habits of thought and actions as those occupations which call into play only the action of certain groups of muscles is to cause bodily deformities. Anything which will prove injurious to the delicate nerve substance must be avoided, as laziness, idleness, and, worst of all, any form of narcotics.

Many-sided life work, consistently carried through, not only strengthens the brain, but also its continued power of adaptation, and one's whole life is a continuous struggle for adaptation. The more the brain works, the more capable it is of receiving new impressions and elaborating old ones, and it retains its elasticity longer.

Hurry generally implies lack of system in carrying out the routine of work, or the undertaking of more work than the individual can accomplish without injury to herself. Few things can more certainly muddle the brain and produce a sense of physical exhaustion than a sense of hurry. Without the sense of this insane driver with a lash in his hands standing over one, she can work more rapidly, with complete self-possession, and do more accurate and better work. The peculiar sense of being hurried has a direct benumbing physical effect, that can often be felt in the brain as distinctly confusing.

The Toxins of Fatigue.—By speeding the machinery to the utmost, a strain is placed on nerves and muscles, and they are kept keyed up to the greatest possible tension. There is a natural pace that one can keep up; force the pace, and weariness results. A man can go for hours at the rate of five miles an hour; he can run at the rate of six miles an hour for quite a long while; but if he tries to run eight miles an hour, he will drop out very soon. The powers of endurance must be gradually developed, but no machine should ever be run at its utmost speed.

By undue pressure, at any period of life, it is possible to use up energy that ought to have been spread out over long periods; and this is emphatically the case during adolescence; too heavy a drain is made on futurity, which means a serious breakdown, or, at least, premature old age.

It has long been assumed that during the activity of muscles substances were produced which exerted a poisonous influence upon the muscle tissues. Exactly what these substances were was not known, but it was supposed that they were definite products of metabolism or tissue waste. It is a well-known phenomenon, observed during the training of athletes and soldiers, that prolonged and disciplined exercise makes it possible for individuals to support easily an amount of work which would prove exhausting or even fatal to the untrained. Increased work, under any circumstances, means increased metabolism, and consequently a more rapid accumulation of its products.

A German investigator, Dr. Weichardt, has shown that if guinea-pigs were put upon a miniature treadmill and forced to run it until they dropped dead from exhaustion, a highly poisonous liquid could be pressed from their muscles, and that the injection of this liquid or extract into the veins of healthy guinea-pigs produced, when administered in small doses, rapid fatigue; whereas, larger doses caused death, accompanied by all the symptoms observed in the original animal during the process of mechanical tiring.

On the other hand, liquid taken from unworked guinea-pigs had no such effect. Further, that if these little animals were put upon a treadmill and worked to just short of exhaustion, and then were given time to recuperate, as we say, the liquid or extract from their muscles had no such effect: it was quite harmless.

From the results of these carefully carried out scientific investigations, Weichardt has come to the conclusion that fatigue is due to a definite toxin, analogous to that

of diphtheria and tetanus, and he believes that the explanation of the phenomena of training lies in the fact that in the body of the athlete there must be a specific "antibody," which neutralizes the "fatigue toxin" as soon as it is formed.

In the animals undergoing these experiments of extreme fatigue there was a fall of temperature. A practical use of this fact could be made for the individual, by noting the fact that a subnormal temperature was a grave danger-signal.

Other observers concede that fatigue is due to chemical substances, produced in the body as the result of brain and muscle activity, and find that these toxins produce a depressing effect, especially on the muscular system, and that the sensation of fatigue is in large part the manifestation of this depression. The action of toxins is not confined to the tissues in which they arise; excessive activity of one tissue can cause fatigue of others. The facts of acid intoxication are noticed as analogous to fatigue phenomena, so far as the latter are due to toxic substances. As antidotes, only rest and sleep can be relied upon.

Observations in the electric experiments on nerve-cells have shown a remarkable shrinking of the nerve-cells, and especially of their nuclei. After five hours' continuous work, the cell nucleus was only half its normal size, and twenty-four hours of rest was necessary in order to restore it to its normal size, but half that amount of work does not require half that amount of time for its recovery.

The mental symptoms of normal fatigue are loss of memory; the sense of perception is less acute; the association centers act less spontaneously and therefore slower; the vocabulary diminishes; the emotional tone is lowered; the attention is unstable and flickering. All these are marked symptoms that the individual is far below her best. All kinds of perceptions are more acute in the morning.

Fatigue is not, therefore, merely physically uncomfortable; it is intellectually, physically, and morally dangerous.

Overwork.—A surplus nervous energy must be persistently aimed at—what Emerson calls "plus health." It must be indelibly impressed on the intelligence of every one that no fatigued individual can be at her best; she is doomed to do inferior work, to be mentally depressed, and to be morally weakened. Hope and courage ooze away, and all sense of proportions and perspective are lost.

The amount of work that can be performed without fatigue is a matter of individuality, and the only safe gauge of overwork are the danger-signals sent out by nature—loss of appetite, insomnia, increasing exhaustion from day to day without increase in the amount of work done, mental depression, lack of interest and initiative. No one can afford to disregard these danger-signals.

Habitual overwork produces fag and a desire for stimulants to act as a spur to the overworked muscles during the day, and recourse to increased stimulants or sedatives to act as hypnotics at night. The inert nerve-centers have no reserve energy to give out, so it is worse than useless to stimulate them. On the other hand, the nerve-centers are at too low an ebb to react from the depressing effects of sedatives, which, to the individual, must be positively injurious. The aim must be to promote nutrition, and to give complete rest to the exhausted nerve-centers.

Brain work, to be beneficial, must be regulated with the greatest care. During the exercise of the brain there is always an increased blood-supply to it. If the exercise is continued too long, there is a tendency for the blood to remain in too great quantity, due to the exhaustion of the nerve-cells, which are no longer able to control the vessels.

During sleep the blood-supply to the brain is diminished and the cells recover themselves, but if this hyperemia

be persistently kept up, sleep soon becomes impossible, the brain-cells have no opportunity to become repaired, and their activity is diminished.

Richardson says: "Making all allowances for differences, even in the prime of their mental and physical vigor, few individuals can exceed six, and for most persons prudence would direct not more than four or five hours of close mental application, without seriously endangering their health."

No real advantage is gained by eight or ten hours of daily study, since the memory and reasoning powers become so exhausted that the assimilation of ideas becomes slower and more difficult. When in his prime, Walter Scott declared that six hours a day was all that he could profitably spend upon his literary compositions. In later years, because of his pecuniary embarrassment, he worked beyond this limit, and, as the result of excessive labor, his last years were spent in hopeless imbecility.

Signs of Overwork.—These show themselves in irritability, with a sense of exhaustion, the irritability being due to an exhaustion of the nerve-centers. Work becomes irksome. There are periods of depression and melancholia, which recur at shorter and shorter intervals and continue for a longer period of time. There is a slight loss of memory, together with inability to concentrate the mind upon any given subject for any considerable length of time, and the power of thought and judgment are impaired. There are sleepless nights, ringing in the ears, fatigue from the slightest exertion, an irregular action of the heart, with palpitation and a frequent desire to urinate. Various forms of pain and neuralgia occur.

There may be as yet no loss of flesh or impairment of the appetite, but this condition of cerebral anemia furnishes the possessor with a pair of blue spectacles through which the intelligence must look, and which throw their own color over everything. Distressing dreams and unrefreshing sleep allow the brain little opportunity for either rest or repair. The mind becomes as sensitive

as the skin after a blister, and the calm, vigorous mental labor is superseded by feverish anxiety, wearing responsibility, and vexing chagrin.

When the brain is well supplied with a powerful circulation, and a rich blood-supply from a good digestion furnishes it with an abundance of pabulum, the cares of life are borne with equanimity and cheerfulness. One of the most unerring signs of failing health is the inability to withstand the pressure of these same daily cares. When the cares that formerly sat lightly on the shoulders become well-nigh an insupportable burden, a state has been reached where the mind reacts on the body.

Worry.—It is readily evident that worry is bred of exhaustion, and is one of the signs of overwork; but, if too often indulged in, it becomes a fixed habit, and the mind rapidly becomes settled in a state of gloom.

It is most important for overwrought business and professional women, but most especially for those women whose vocations in life combine three distinct occupations or callings—namely, wives who act in the capacity of housekeepers, ministers of finance to the household, and the bringing up of children—to realize the importance of not undertaking more than they can accomplish without fret and worry. The overconscientious woman may object that it is selfish to consider her own comfort when she has work to do for others, but to expend too freely of the nervous energy, even in a good cause, is like giving so much of our substance to charity that we ourselves are in turn obliged to lean on others for support. In properly conserving our own energies, we may ultimately be lightening the burden of others. There is a proper balance between the duty one owes to one's self and to others.

Once bred, worry is an endless chain. Tell such a woman not to worry, and she worries for fear she may worry. She is afraid that she has decided wrongly, and regards decisions in regard to the most trivial affairs of life as though they were matters of vital importance.

The obsession "to arrive" is a fertile source of fret and worry. This habit of mind leads to frantic and incessant labor and blocks all pleasure at every point. The person who plays a game only to see who wins, loses half of the benefit of the recreation.

"The legs of the stork are long, the legs of the duck are short; you cannot make the legs of the stork short, neither can you make the legs of the duck long. Why worry?" (Chinese proverb.)

Insomnia.—This is another symptom of overwork. The mind, worried and harassed all day, retires at night to struggle in the darkness and solitude with worries, forebodings, doubts, and regrets, which now assume gigantic and fantastic shapes. In this case the insomnia is due to faulty habits of mind.

Another form of insomnia is caused by intellectual work being carried on at night until time for retiring; the mind is then so fully saturated with the subject that it is unable to throw it off on going to bed.

Whatever be the cause of the insomnia, it soon becomes a fixed habit, and, whether it is a case of laying awake a long time before sleep comes, or waking up at a regular hour toward morning,—and it is a curious fact that the habit of waking up recurs at almost precisely the same hour in the morning,—the longer this habit of insomnia is indulged in, the more difficult it is to break it up.

Nervousness.—This is a well-known sign of overwork, which shows itself in intense nervousness and irritability. Everything jars on the nerves. The woman gives way to her emotions, over which she loses control.

To keep placid when overworked to the limit of physical endurance requires a stolidity of soul and lack of nerves only known to the North American Indians, and perhaps the Japanese, and it matters not what the kind of overwork is, whether business, pleasure, or charity.

Nature's Restoratives.—The proper division of the day is eight hours to be alloted to work, eight to sleep, and the remaining period of eight hours is to be divided

among the various methods of refreshing body and mind —the toilet, eating, rest, and recreations.

Not only are rest, recreation, and sleep in proper proportions essential to the health of the body, but they are equally essential to the quantity and the quality of the output of work. From them result a feeling of physical well-being, an exuberance of animal spirits which go into the work. The perspective is more accurate, the judgment is clearer, and the creative power is greater. Work goes of itself with a swing. Happiness is an expansive quality, that makes itself felt throughout the entire body, but its effects are most manifest in the mental power.

The mother who so honestly works and plans for the good of her family as to give herself no time to rest after her physical efforts is in such an exhausted condition as only to be able to give them the tired and critical side of herself for daily association. There are few human achievements much finer than to make human beings happy, and this power woman is endowed with to a very large extent.

Rest, to be of value, must be systematically taken. Bearing in mind the shrinking in size of the nerve-cells after stimulation caused by work, and that they recovered their normal size in relatively less time if the shrinkage were less, it becomes obvious that, in order to accomplish the best work, whether purely mental, or of the more complex mental and physical work demanded of the mother who is at the same time the housewife, that a break in the day's work will aid in securing the best results.

The exact time of the daily *siesta* must be adapted to the family régime, but a fixed hour should be set aside for this purpose, and this should be known as the mother's hour, and nothing short of a catastrophe should be allowed to infringe on it.

The woman should retire to her bed-room, undress, and go to bed. The room should be darkened, and at

the same time there must be an abundant supply of fresh air. One soon forms the habit of taking a short nap, of perhaps half an hour; one hour should be spent in bed. After this, she gets up, takes a shower or other bath, dresses, and is then ready to enjoy life and be a comfort to her family. In this way alone can absolute relaxation, rest of mind, and body be secured.

Avocation.—Second only to the physiologic necessity for a vocation in life, is the necessity for an avocation, and this must be in the nature of a recreation.

It is a well-known fact in farming that any one kind of crop will exhaust the very best soil, but few people recognize the necessity for a change of occupation and recreation in order to produce the best mental and physical results.

Joyless drudgery drains the springs of health. There is a mental starvation, due to the lack of recreation, as well as the physical, due to the lack of bread. The French aristocrats, noted for the gaiety of their pastimes, in spite of their dietetic and other sins, furnish a remarkable list of longevity. Persons of a cheerful disposition are generally long-lived, and anything tending to counteract the influence of worry and discontent directly contributes to the preservation of the health. Despair, which frequently results from years of overwork, can paralyze the energies of vital functions like a sudden poison, while hope fulfilled has cured many a disease.

The nature of the avocation chosen will necessarily depend upon the character of the vocation. For women whose vocations are intellectual and sedentary, as writers, teachers, stenographers, etc., some outdoor employment, which calls into activity the muscles of the body, rests the eyes and brain, and, at the same time, pleasantly occupies the mind, is the best, as walking, gardening, lawn-tennis, golf, rowing, etc.

For all women engaged in sedentary occupations, daily exercise in the open air is the first essential, and let them be assured that their feelings of fatigue and disinclination

to exercise are no safe guide as to their ability to take exercise.

The first cause of the feeling of fatigue is due to the lack of oxygen in the lungs and the impure air of the room. On going out-of-doors, the woman will be surprised at how much stronger and better she feels after an hour's brisk walk than she did on starting out.

"Fancy work" and lace-making, instead of being classed with recreations, must be classed with fine hand-sewing of the most taxing kind. It calls the same groups of muscles into play, and is productive of the same evils, with a greater tendency to produce eye-strain and a paralysis similar to writer's cramp.

The proper avocation of the tired housewife, who has been on her feet all the time and whose vocation is manual labor, will be the diversion of the mind by reading a good book, while comfortably pillowed on a veranda chair, a drive, a visit to some congenial friend, a game of cards, or music.

Literary clubs for women should be more largely organized through the country and in country towns. In the cities women have found these clubs a great boon, not only to the health and happiness, but they are in the highest degree educational.

Further, women have found that these literary clubs were profitable, as a means of bringing their minds in contact with other educated minds, and thus they had not only the additional stimulus to study, but a broadening of their horizon, which the woman's heretofore shut-in household life had precluded. Courses in domestic science would be a boon to the home.

The greater the number of interests which education and culture have created, the greater will be the diversity of the recreations open for the woman's enjoyment.

Care must be taken that the avocation, which is at first an enjoyment and relaxation, is not turned into hard labor. The moment that any one strains every nerve,

even to excel in a game, that moment it ceases to be a relaxation.

History shows that the laws of all nations have always provided a certain number of days of rest, or at least a change of occupation, and that these days were fixed at more or less regular intervals. This was partly from a religious and partly from a hygienic standpoint. The necessity for the interruption of the regular routine work has always been recognized, and one day out of every seven has been set aside for this purpose.

The custom that is so frequently adopted by city folk of going out of town over Sunday might very well be imitated by country folk by going into the town or city over Sunday. For not only is the too continuous application to one's employment fraught with danger, but it has been conclusively shown that a monotonous routine of occupation, such as lived by the average farmer's wife, is a severe tax on the sanity of the mind. Statistics show that the heaviest percentage of insanity falls on farmer's wives, and the supposed cause of this is the monotony of their lives.

A horse cannot gallop as many hours as it can walk, and the daily task should be the sum-total of what man or beast can do compatibly with health. To combine a day of toil with a second of amusement in one twenty-four hours does not give the proper allowance for sleep, and cannot be done without injury to the individual.

Fun and laughter are the most efficacious remedies in the pharmacopeia, and tired humanity owes a debt of gratitude to the guild of humorists, be they writers, comedians, or musical composers.

The Physiologic Necessity for Laughter.—The attitude of the individual varies with age, temperament, and the perspective of life. Grave adults are apt to think of laughter and smiling as something occasional, a momentary lapse once in a while from the persistent attitude of seriousness. Healthy children, on the contrary, consider that a state of laughter is the normal condition of human-

ity, and that seriousness is a tiresome necessity, which must be tolerated from time to time. But very few people have any idea that there exists a well-defined physiologic necessity for laughter, and the greater the intellectual labor and the mental strain, the greater is this necessity.

The deep forcible chest movements increase the rapidity of the circulation, the force of the heart's beat, and secures a more complete oxygenation of the blood.

It is not improbable that this accelerated circulation produces remote effects on the organism. One of the immediate effects of a good laugh is that it relieves the brain by the rapidity of the movements of the blood through the capillary circulation.

In addition to the immediate physiologic effects which result from laughter it is highly beneficial, by relieving the brain and nervous system from the intense strain and tension of the daily affairs and occupations of life, and gives relief to the severely congested capillaries, which otherwise involve considerable risk to the individual.

Physiologists hold that pleasurable feelings tend to further the whole group of organic functions, and that laughter produces a considerable increase of vital activity by the heightened nervous stimulation. There is a sense of increased energy, of a high tide of the fulness of the life current.

Vacations and Health.—The secret of success of the old Romans in conquering the world lay as much in their ability to maintain the health of their troops in their various campaigns as by the courage and organization of those troops; or, rather it may be said that courage is but the coefficient of a good physique and a general mental vigor.

A rest one day out of seven, with an occasional outing for the week-end, is good but not sufficient. If one would keep up to her highest standard of physical and mental efficiency, she must have at least one month of absolute change of environment and outdoor life in the year.

The kind of place one choses for her vacation will

depend on where her home is. To dwellers in cities, the mountains and seaside resorts are the most beneficial. August is our most trying month, and every one who can would do well to take her vacation at that time, always selecting some resort north of her own home, so that she may have the additional advantage of a more bracing climate.

Maine furnishes many of the most beneficial of our health resorts, combining as it does so many attractions—its bracing atmosphere of pine forests, its beautiful scenery with vast expanses of water, and the great variety of diversions which it affords.

It is always wise to send an advance scout to investigate the place in which you contemplate spending your vacation. Avoid low and swampy land; investigate the character of the water-supply and the nature of the plumbing, together with the sewerage system, for it is all too frequent that an attack of typhoid fever follows an outing in the country. Every good summer resort should furnish facilities for a variety of outdoor sports—golf, tennis, boating, swimming, etc.

During the vacation needless exposure to the direct rays of the sun must be avoided. There is probably nothing which lowers the vital resistance, and so prepares the way for disease as much as exhausting exposure to the hot rays of the sun.

Long hours of sleep should be indulged in. The morning air is the most beneficial; it is, therefore, a good habit to retire early and to rise early.

If the vacation is not properly spent, it may be the means of doing more harm than good. On the other hand, if properly spent, vacations prepare one as nothing else can to meet and resist the vicissitudes of the following winter. It is the people who go off on long vacations who have the least need of the doctor's care.

Sleep.—During sleep all the bodily functions are in abeyance and the secretions are diminished; respiration is slow and confined to the chest, so that the amount of

inspired air is only one-seventh of that during the waking hours; the temperature of the body falls; less blood circulates through the brain; and the sensibility of the nerves to external stimuli is diminished. Sleep is not only *par excellence* the time of repose and recuperation of the brain and nerve substance, but it is the only time when, by the diminution of waste caused by the incessant activity of the brain, that the organ can be properly nourished, the deficit in nerve force canceled, and the surplus of energy stored up.

Without this absolute remission of brain activity every twenty-four hours an actual destruction of substance would occur, which, if persisted in, would be so depressing to the nervous functions as to be inconsistent with life, and this is the case in the concluding stages of fatal diseases.

The sleepy feeling caused by fatigue is due to the circulation in the blood of toxins resulting from tissue waste, which benumb the brain-cells; while the feeling of freshness and *bien-être* with which one awakens in the morning is due to the elimination of the fatigue products from the blood during sleep. If the blood of a tired dog be transfused into the veins of a perfectly fresh animal, the latter will immediately show symptoms of somnolence and seek a dark corner for sleep.

The medical authorities of to-day are pretty well agreed that eight hours of sleep is the minimum required for the maintenance of health, and all concede that the brain-worker requires more sleep than the manual laborer. Every moment after the feeling of languor presents itself is a strain upon the nerves and muscles which will sooner or later invalidate for life, and finally bring the victim to a premature grave. Habitual deficiency of sleep will undermine the strongest constitution.

It is a matter of great importance to train one's self in the habits of sleep, regularity in the hour of retiring, abstinence from active brain work for the hour immediately preceding going to bed, since, if active brain work is con-

tinued until one goes to her room for the night, the chances are that the brain will continue its activities after getting into bed, and sleep may be banished from the pillow for several hours.

A few minutes spent in breathing exercises, the vigorous use of the flesh brush or hair glove, a hot plunge or foot-bath are no mean hypnotics.

A sound sleep is dreamless. Dreams require a certain expenditure of nerve force and mental energy, so that dreamless sleep is the most restful. Disagreeable dreams and "night-mares" are generally associated with indigestion and biliousness, which also occasion a general restlessness. All this can be overcome by taking some medicine for the liver. Two grains of calomel taken just before retiring often works like a charm. The dose must not be repeated under a month. In case of tendency to insomnia, no coffee should be taken after breakfast.

Treatment of Insomnia.—The mechanical measures for the relief of insomnia have for their purpose the withdrawing of the blood from the brain to the surface of the skin. Hot foot-baths; general warm baths; cold douches to the spine, brisk exercise; light massage, and cold rooms. Mental work should be laid aside several hours before retiring; late suppers avoided; coffee, if taken at all, should only be taken for breakfast, and then only one cup. Reading or amusement should be selected that does not excite the nerves.

To woo sleep the woman should put herself in a position of rest, which of itself physiologically induces sleep. Avoid irritations, noises, bad air, cold feet, overloaded bowels, all of which tend to wakefulness and to prevent the proper physical rest. Then sleep usually comes of itself.

The Eyes: Eye-strain.—Of all the misfortunes that could befall a human being, the loss of sight is probably the greatest, and yet no organ of the body is so constantly abused as the eye.

The trouble is that the possessor of the normal eye

does not take into consideration that in all near work, as in reading, writing, sewing, etc., the eye is actively engaged as well as the hands and brain, and that the eye only is at rest when looking into space or when closed.

Description of the Visual Apparatus.—The eyeball is contained and protected in a bony cavity, formed by the bones of the face and skull, and is supported by a cushion of fat and other tissues. It is held in place by its membranes and muscles, by which it is also moved. It is further protected by the eyelids, the eyebrows, and the eyelashes. The eyebrows protect the eyes from dust and perspiration and shade the eyes.

The eyelids are lined by a very delicate mucous membrane, called the conjunctiva. They are maintained in close apposition to the eyeball by atmospheric pressure. The tears are secreted by the lacrimal gland, which is at the upper and outer angle of the orbit. The lubrication by the tears and the mucus secreted by the conjunctiva cause them to move smoothly and without friction. An important function of the lids is to distribute the tears over the front of the eyeball, and by incessant winking to free the front of the eye from dust and to keep it moist.

The conjunctiva is continuous with the mucous membrane of the nose and mouth. Hence, in inflammation of the nasal mucous membrane, as in an ordinary cold in the head or influenza, the conjunctiva is liable to become very much congested or inflamed.

The *eyeball* is spherical in form, having the segment of a smaller and much more prominent sphere ingrafted on its anterior part. The segment of the larger sphere, which forms about five-sixths of the globe, is opaque, and forms the sclerotic coat, the so-called "white" of the eye. The smaller sphere, which forms the remaining sixth, is transparent, and is formed by the cornea.

The *iris* is a circular contracting membrane, suspended from the edges of the cornea, in front of the eye like a curtain. The iris gives color to the eye, and when we

say that an eye is blue or brown, we mean that is the color of the iris. The iris is freely movable, and, according as to whether it dilates or contracts, there is an alteration in the size of the central aperture, called the pupil.

The chief function of the iris is to regulate the quantity of light admitted to the interior of the eye. In a very strong light the pupil quickly contracts, shutting out the excessive light, while in a subdued light the pupil dilates, thus allowing more light to enter. When looking at a distance or when looking languidly into space, the pupil dilates.

The Formation of the Image.—The eye is a camera, consisting of a series of lenses and media arranged in a dark chamber, the iris serving as a curtain. The object of the apparatus is to form on the retina a distinct image of external objects.

The Mechanism of Accommodation.—In the passive condition of the eye, when it is adjusted for far objects, the anterior surface of the lens is somewhat flattened. Accommodation for near objects consists in a contraction of the circular ciliary muscle and an increase in the convexity of the anterior surface of the crystalline lens.

The light enters the eyeball through the pupil, falls upon the retina, which has often been compared to the sensitive plate of a camera, is received and transmitted by the optic nerve to the visual centers of the brain. The eyeball does not see. It is only a sensitive end-organ, which receives and transmits the impressions to the higher centers of sight. The act of vision is performed in the brain.

The focusing power of the eye is the property of bending nearly parallel rays of light from distant and divergent rays or from close range so that they meet exactly on the sensitive retina; this is called refraction. In the normal eye these rays are focused exactly on the retina.

Optical Defects and their Correction.—In the normal eye the near limit of accommodation is from 4 to 5 inches, and the far limit may be put at an infinite distance.

Myopia or Near-sightedness.—This is one of the most

common refractive defects of the eye. In this condition, because of the greater length of the eyeball or increased refractive changes of the media, rays of light from a distance are focused in front of the retina, producing an indistinct image.

The near-point is brought much nearer—from 2 to 2½ inches—and the far limit is at a very short distance.

In reading, the myope is obliged to hold her book very close to the eyes in order to see. In doing so, she strains her muscles of convergence, producing ocular congestion and compression of the eyeball.

The predisposing causes of myopia are heredity; it is said that half of myopics are descended from near-sighted parents; uncorrected astigmatism, and the effort to read very fine print or figures, entails severe strain on the eyes, which may result in myopia.

Myopia is corrected by a concave lens, which diverges the rays of light, prolonging the focal distance, so that the rays of light are focused exactly on the retina.

Not only are myopic eyes not injured by wearing suitable glasses, but, on the contrary, are often preserved from injurious pressure on the globe, due to the indulgence of the habit to nearly close the lids in order to see better, as is commonly done when glasses are not worn.

Hyperopia or Far-sightedness.—In this condition the eyeball is too short, and the rays of light from a distance are focused behind the retina. Instead of being distinct, the image is blurred. Hyperopia is corrected by a convex lens, which converges the rays of light, bringing them sooner to a focus. In the hyperopic eye the near-point of accommodation is at some distance, and a far limit of accommodation practically does not exist.

Presbyopia.—This is a loss of the power of accommodation, by which reading, writing, sewing, and other near work is accomplished. This power of accommodation is greatest in early life, and gradually diminishes until about the age of forty years, when reading at the ordinary distance becomes uncomfortable. At about

seventy-five years of age the power of accommodation is practically lost.

Every person over forty-five years, with normal or far-sighted eyes, should wear glasses to perform near work.

Astigmatism.—Astigmatism does not depend on the length of the eyeball, but on the curvature of the cornea, and rarely on that of the lens. Uncorrected astigmatism necessitates the expenditure of more muscular effort in the attempt to see distinctly than is necessary when

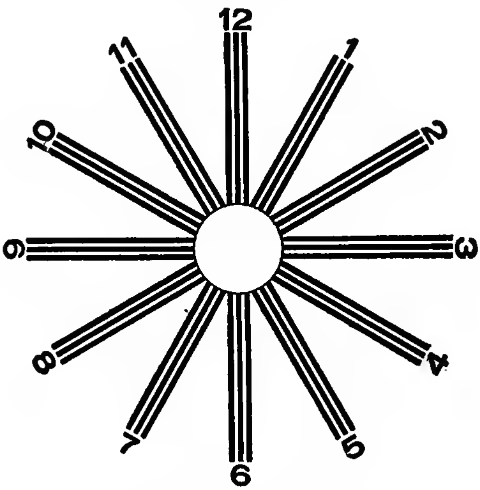


Fig. 12.—Astigmatic chart.

refraction is normal. This is accompanied by early fatigue and more or less congestion of the vascular tunics of the eye. Astigmatism is corrected by a cylindric lens, which has a plane surface in one axis and a concave surface in the axis at right angles to it.

In simple astigmatism, on looking at the accompanying astigmatic chart with each eye separately, certain lines in the defective meridian seem very much blurred, while those at exact right angles appear clear and black. This

furnishes a test for astigmatism, since to the normal eye the lines appear of equal distinctness and clearness. Astigmatism is a very common ocular defect.

The Mechanism of Eye-strain.—Comparatively few eyes are perfect. Far-sighted or astigmatic eyes can secure perfect vision by means of accommodation. By constant strain on the ciliary muscle, the crystalline lens is so increased in curvature as to exactly counterbalance the optical defect of the eyes.

Healthy eyes should do their work without the consciousness of the owner, and this is a safe test as to the kind and amount of work demanded of them.

Perfect rest for the eyes is impossible in the waking state—distant vision represents rest for the eyes and near vision exertion.

Near work is the chief cause of near-sightedness. Distant vision should alternate with near work, and in near work the object should not be brought nearer to the eyes than 12 inches.

The Local Symptoms of Eye-strain.—There may be a sense of fatigue in the eyes after reading for a short time, and this may be followed by a constant sense of discomfort in the eyes, which is increased on using them, and which may be accompanied by severe pain in the back of the head. There is a sensitiveness to light, and inflammation of the eyelids and conjunctiva. There may be twitching of the eyelids, and in extreme cases difficulty in keeping the eyes open on account of drowsiness. The eyes may smart, itch, or burn, and continually "water."

As the trouble becomes more pronounced, reading for a short time may be followed by a blurring of the type, and finally the lines may run together. There is a constant sense of the eyes feeling for the lines, and, perhaps one of the first things to call attention to the condition of the eyes may be the losing of the lines in reading.

The general or reflex symptom of eye-strain is headache, which frequently takes the form of migraine. This

is increased on reading, sewing, riding in the cars, etc. The headache is usually over the region of the temples or just above the eyes, but it may be on the top of the head or at the base of the skull.

Vision is so fundamentally related to all the brain functions that eye-strain, or anything which interferes with normal sight, may cause the most varied disturbances of bodily functions.

The Prevention of Eye-strain.—Persons whose work necessitates much ocular labor should vary their duties with intervals of rest. In continued reading or sewing it is well to desist at short intervals and fix the gaze on some distant object, and to frequently close the lids.

Lace work, very fine needle work, working on black goods, reading very fine print, or print on an inferior quality of paper, or attempting to read in a dim light, are all a severe tax on the eyes, and should be avoided, as they are certain to cause them permanent injury.

Defective vision is so common in school-children, it is so often present without being suspected, and so much harm is done to the eyes and the general health of the individual before it is discovered, that there should be a compulsory law requiring the examination of all school-children; and, again, before boys and girls enter the normal schools and colleges.

Clear vision gives clear judgment; defective vision in its various manifestations gives different warps and bents to the mind of their unfortunate possessors.

Veils.—The wearing of veils is responsible for not a little deterioration of vision, particularly when they are thick or dotted. Unless the meshes of the veil are very large, it holds a layer of impure air close to the face, so that the wearer is breathing vitiated air. It hinders clearness of vision, because the external world is viewed through a narrow lattice.

The best veil for the eyes is one with a single mesh, either without dots, or the dots so far apart that none shall come over the eyes.

Protection of the Eyes from the Glare of the Sun.—In very hot weather the eyes should always be so protected that the rays of the sun do not shine directly into them. This protection may be afforded by the brim of the hat or by a parasol. At the sea-shore, or on an ocean voyage, where the glare of the sun is constant and particularly trying, the eyes should be protected by wearing slightly tinted smoked glasses.

Artificial Lighting.—The main sources of artificial lighting are kerosene, gas, and electricity. The principal questions of importance are the quantity and quality of the light, its steadiness, the vitiation of the atmosphere by the products of combustion, and the expense; also the proper arrangement of the light.

Kerosene is the most extensively used means for artificial lighting. The principal objections are—the heat, the trouble of filling and keeping the lamps in order, and the danger of explosion and fire if upset; the odor and the great vitiation of the atmosphere.

The modern lamp gives a brilliant light, and if properly shaded by a slightly bluish chimney, so as to absorb the excess of yellow rays, it is very satisfactory.

Illuminating gas, as furnished in cities, has a great excess of yellow rays, which are very injurious to the eyes, and the vitiation of the atmosphere is very considerable. Gas-light is modified by the Argand and Bunsen burners. Of these, the Bunsen burner, a patented composition burner, heated to incandescence, is the best. It gives a white light, resembling daylight, and, under proper adjustment, a far greater volume than any other burner. It is not so hot, does not consume as much gas, and so there is less vitiation of the atmosphere. It is intensely brilliant, and must be shaded by ground glass or a proper shade.

Electricity gives the very best light, with a minimum amount of heat and vitiation of the atmosphere. For individual use 16-candle power is sufficient.

The lamp-shade should be opaque, of a dark-green color, and lined with a white, reflecting surface. Transparent

lamp-shades, especially when patterned, are always bad, whatever their color; because of the different degree of illumination thrown upon the work, the light is irritating to the eyes.

Hygienic Precautions in Reading and Sewing.—There should be free access of open daylight. Near the window is obviously the best place for working, and the seat should be so selected that the window is to the left of the worker. This prevents the work from being shaded by the hand, and protects the eyes from being fatigued by the light falling directly into them.

Any room will have too much light into which the sun shines directly. Even if the worker's face is not turned directly toward the sun, yet the light reflected from the book or other work will be so intense as to be dazzling. The softest and most pleasant light to work by is the diffused light from the northern sky. An excess of light may be easily regulated by a shade.

Reading.—Very fine type should always be avoided, it is a very unnecessary strain on the eyes, as are also books printed on a poor quality of paper with improper spacing. The paper should be unglazed.

Length of Line.—The length of the printed line should not be more than 4 inches, nor less than 2¾ inches; that is, not more than 10 or less than 7 centimeters. If the line is too long, the effort to find the succeeding line is too great. If, on the other hand, the line is too short, the lateral movements of the eye are so frequent that the muscles concerned in these movements soon become fatigued.

The position of the reader should be sitting upright, with the back toward the light, which should fall over the left shoulder, and the book held nearly on a level with the eyes. The book should be held at a distance of about 12 inches from the eyes. The light should be on a level with the head or slightly above it. In desk work, a shade should always be worn to protect the eyes.

Reading in the recumbent position is a pernicious habit,

and is particularly bad when convalescing from an illness or when very tired.

Reading in carriages or cars is injurious to all eyes, but especially so to myopic eyes; because of the constant jolting, the distance between the type and the eyes is continually changing, necessitating the frequent and abrupt adjustments of accommodation; besides, the illumination is apt to be very poor. Reading in a dim light or the twilight is also very bad for the eyes.

Sewing and embroidery require the most trying ocular labor and the best conditions for illumination. Working on black goods by artificial light should be absolutely forbidden.

Injuries to the Eyes.—The most common injuries to the eyes are the entrance of small particles of dust, cinders, steel filings, etc., into the conjunctival sac, or into the substance of the cornea. Frequently, with the aid of a little winking, the tears wash away these foreign substances, but if the susbtance lodges in the lining membrane of the upper or lower lid, or is imbedded in the cornea, it may be necessary to resort to other means in order to remove them.

The lining membrane of the lower lid is brought into view by simple tension of the lower lid downward by one finger. If the offending particle is not seen, the upper lid should be everted. This may be easily effected by the fingers alone. The patient is told to look down, the edge of the upper lid and the lashes are seized by the thumb and forefinger of the right hand, and the lid is drawn at first forward and then downward away from the eye, then upward over the point of the thumb or forefinger of the left hand, which is held stationary on the lid and acts as a fulcrum. The foreign body should be removed with the handkerchief, but, if it is imbedded, it may be necessary for a competent physician to remove it.

The habit of opening the eyes when dipping the face into a basin of water, or when diving, produces congestion and inflammation of the conjunctiva.

Symptoms and Treatment of Conjunctivitis.—The eyes may be blood-shot and the lining membranes of the lids intensely red. There is a sense of irritation about the eyes and an intolerance of light, with a constant sense of discomfort. The sensation produced is that of having sand in the eyes. The eyes are heavy, and tire after using them for a short time.

The best treatment for acute conjunctivitis, which is so often caused by the penetration of dust or other foreign bodies into the conjunctival sac, is the application of cold water. A folded handkerchief is wrung out of ice-water and laid on the closed lids. It must be changed every few minutes, so that it shall not become warm; two cloths are necessary. When the acute symptoms have begun to abate, the patient will no longer find these applications grateful, and they must be discontinued.

For chronic conjunctivitis hot applications are the best. For these, one teaspoonful of fine table salt may be dissolved in a pint of hot water, or two teaspoonfuls of boric acid may be used instead; the last named is a mild antiseptic. The boric acid dissolves very slowly, so that it is well to prepare enough in the morning for the entire day. One tablespoonful of boric acid may be put into a quart bottle of hot water, and be well shaken from time to time, until there is a perfect solution.

When ready for use, half a pint may be heated, poured into a tumbler, which is then placed in a basin of hot water; this latter serves as a water-bath to keep the solution in the glass hot. The application should be made with a rather thick wad of absorbent cotton or a piece of fine cheese-cloth. The absorbent cotton should be picked up with all the water it will hold, and be placed over the closed eyes just as hot as can comfortably be borne, and held there until it begins to cool, when the procedure should be repeated. The two eyes can be treated simultaneously. These hot fomentations should be kept up for ten minutes, and be repeated four times a day.

Trachoma.—This malady, of which so much is heard

now, is another name for granular conjunctivitis or granular lids. The affection is very contagious. It comes on slowly, and is frequently accompanied by redness and an appreciable degree of secretion in the early stages. Presence of secretion or of interference of the vision should always attract attention.

Strict precautions must be taken that the patient's handkerchief, towel, and wash-basin are not used by other members of the family. Further, the other members of the family should bathe their eyes several times a day with a solution of boric acid.

Styes.—Styes are a very painful species of small boils that generally form on the edges of the eyelids. They are apt to appear in succession. Certain persons are liable to them if the system is run down from general causes. Like boils in other parts of the body, they give evidence of impaired nutrition.

Hot fomentations of boric acid solution will sometimes abort them if used early. If pus has formed, the stye must be opened by an incision parallel to the edge of the lid. This should not be attempted by any one except a physician.

Color-blindness.—As a rule, about 4 per cent. of males and about one-half of 1 per cent. of females are color-blind. The part of the color sense that is most often deficient is that for green and red.

Cataract.—This is a disease in which the crystalline lens or its capsule, or both, lose their transparency and become opaque. Eventually total blindness is the result. Senile cataracts appear after the forty-eighth year. The only remedy for the disease is the surgeon's knife.

Functional Nervous Disorders.—Evidences of sound health are: first, individual adaptability or capacity of the individual to easily adapt herself to extremely opposite conditions of existence; second, endurance, or the capacity to do a considerable amount of mental work for a short time without suffering fatigue, or to be able to quickly recover from the fatigue; third, to be able to

control the emotions; fourth, to be able to resist morbific influence; that is, the capacity on the part of sound organs of excretion to quickly eliminate all poisons from the system.

The signs of debility are just the reverse: first, deformity, obesity, or leanness; second, personal inadaptability, that is, when physical or mental discomfort is caused by such slight provocations as change of food, clothing, or climate; third, lack of endurance, so that a long rest is required to repair the fatigue incident to slight exertion; fourth, lack of control of the emotions; fifth, a proclivity to morbific influences, so that the individual succumbs to every contagion or miasm that she encounters.

Nervousness is a disease of civilization, coupled with overwork and indoor life. The more complex the environment in which the individual finds herself, and to which she must adjust herself, the greater the demands made on the nervous system.

The extreme dryness of our climate, together with the great variations of temperature between winter and summer and the rapid fluctuations of temperature, predisposes to nervous disorders.

Headache.—Headache is a symptom rather than a disease, but there is no symptom which requires more careful investigation of its cause than that of headache. It occurs at all ages, but is most common from ten to twenty-five years and from thirty-five to forty-five years. Women suffer from headache more than men, in the proportion of about three to one. Headaches are most common in the spring and fall of the year and in the temperate climates.

Causes of Headache.—These may be classified into those in which the blood is at fault; reflex causes; various nervous disorders; and organic diseases.

The blood may be impoverished, as in the case of anemia, where there is a deficiency in hemoglobin; but by far the most frequent cause of headache is where the blood is

disordered, as in gout, rheumatism, kidney diseases, diabetes, and the infectious fevers and malaria.

Among the more common reflex causes are eye-strain, especially errors of refraction; disorders of digestion, particularly constipation; and pelvic disorders, as in inflammation of the pelvic viscera.

Functional diseases of the nervous system causing headache are overwork, neurasthenia, hysteria, epilepsy, and neuritis.

Among the most common of the organic diseases is arteriosclerosis; other diseases are meningitis and brain tumors.

Symptoms.—The pain is often dull in character and rendered worse by stooping; the location of the pain depends on the cause of the headache. The most common variety is over the forehead or eyes. In eye-strain the pain may either be in the front or back of the head. In indigestion, the pain is most frequently over the eyes, but it may also be on the top of the head. In anemia the pain may be either frontal or diffuse. In pelvic disorders the pain is generally at the base of the brain, though it is sometimes in the top of the head.

Neuralgic headaches are generally characterized by sharp paroxysmal attacks, located in the temporal regions, and associated with pain in other parts of the body. It is perhaps most frequently caused by anemia.

In hysteria the headaches are characterized by a circumscribed pain—it has been likened to the driving of a nail into the head.

In migraine the pain is paroxysmal and intensely severe; it is frequently caused by some poison in the blood, as in autointoxication, due to failure of proper regulation of the bowels, also by pelvic disorders.

Treatment.—The treatment is constitutional, and is based on the removal of the cause. First, there should be a regulation of the diet, a free evacuation of the bowels, and their proper regulation. In every case of headache there should be an examination of the urine. Often there

is some congestion of the kidneys where it is least suspected. If the headache is persistently made worse by reading or sewing, the patient should be referred to a competent oculist. An inquiry should always be made into the condition of the menstrual function, backache, and leukorrhea. Any marked disorders here will necessitate a gynecologic examination.

For the immediate relief of migraine, the patient should go at once to bed and drink a glass of hot water; sometimes a cup of hot tea gives great relief. No food should be taken for from six to twelve hours, according to the severity of the case. The room must be kept dark and quiet and the head high.

A strip of prepared mustard leaf, 5 inches wide by 8 inches long, should be cut, and a piece of cheese-cloth, 6 or 8 layers thick, should be folded the same size. The cheese-cloth is then wrung out of hot water, and the mustard leaf is quickly dipped into the same. The cheese-cloth is placed on the back of the neck, between it and the mustard leaf. The clothes should be kept dry by a folded napkin. In this way the mustard may be kept on from six to eight minutes, until it begins to burn and the skin get red. If left on too long, the mustard may produce the most painful kind of a blister. When taken off the neck, the mustard may be put on over the stomach.

The medicinal treatment must be directed by the physician, but a perfectly safe prescription, and one which may be kept on hand, is the following: Take of sodium bromid, 15 grains; of essence of peppermint, 10 drops; and of water a sufficient quantity to make 1 dram. Mix well. The dose may be repeated in three hours if necessary. This prescription should be put up by a good druggist, in a three-ounce quantity. Sometimes relief is afforded by 1 teaspoonful of the aromatic spirits of ammonia, taken in four tablespoonfuls of water, and this is about the right quantity of water to take any liquid medicine in. At night 2 grains of calomel should be taken, so that the

patient shall not be disturbed through the night, and it is not so apt to cause nausea as when taken through the day.

Neurasthenia or Nervous Prostration.—This disease first saw light in the United States, and was christened by Beard as an American disease that was absent from no household in which the inhabitants used their brains. It is certainly much more prevalent in this than in any other country. Americans scarcely treat their bodies with more consideration than their automobiles; they put on high pressure and speed them to the utmost. Add to the high pressure under which we live that other fact of heredity, that many persons are born with unstable nerve-cells, and may be nervously bankrupt, and it is not difficult to understand that 50 per cent. of Americans are suffering in some degree from lowered nerve tone.

Causes of Neurasthenia.—All classes of men and women who use their brains severely, and who have seasons of excessive anxiety and responsibility, are subject to neurasthenia. We have seen that fatigue was caused by the accumulations of toxins in the body, due to muscular activity, but these toxins may also be caused by intellectual overwork or anxiety over domestic or business affairs.

Other causes are the intemperate amount of intellectual work which is forced on the brain, and the excessive indulgence of the emotions and the passions. Combined with the strenuousness of life is the large element of uncertainty, the intense anxiety, and the restless energy which is the price of success. Added to these may be lack of suitable and sufficient recreation and short hours of restless sleep; the restrictions of a narrow lot, loneliness, and isolation, the frequent repetitions of uninteresting tasks, added to the burdens of maternity, domestic cares, and worries.

In cities the ear-strain caused by the incessant noises of the street, the amount of work done by insufficient and improper lighting, the unsanitary mode of life, the

improper diet, the monotonous and infertile work, the unhappiness and discontent bred of a life of idleness, or one given to society and gambling, whether bridge whist or poker, the senseless bolstering of shattered nerves with alcoholic stimulants and beverages, patent medicines, and hypnotics, all add their quota to the breaking down of the nervous system.

A man can do a prodigious amount of work if he only varies it with play which really amuses him, or if he substitutes for mental occupation those which involve bodily exercises.

In so-called latent gout insomnia is a frequent symptom, or insomnia may develop as the result of bad nervous habits. Insomnia from whatever cause is followed by the impairment of nerve substance and an overloading of the body with toxins. This continued nerve exhaustion leads to oxaluria, uric acid, gout, anemia, gastric and intestinal dyspepsia, muscular insufficiency, and precordial distress.

Whatever enfeebles the body by overtaxing the nervous system the waste is in excess of the repair, in all overwork the destructive metamorphosis is greater than the reparative processes, and so there is an accumulation of toxic products and a more or less severe and permanent injury is done the nervous system.

Other causes of neurasthenia, not so generally recognized as overwork, are to be found in the pathologic conditions of the intestinal canal, which becomes a veritable culture tube, and absorption from this into the blood constantly takes place. And this condition of putrefaction has to be overcome before relief can be afforded, and in many cases this condition is associated with an insufficiency of the elimination of urine.

The large intestine is the seat of an enormous bacteriologic flora; they are not there by millions, but by billions. Some of them are harmless, but not all of them, and if these pathogenic bacteria are present in sufficient quantity, they, too, may produce symptoms of mild poisoning.

So, too, may mere indigestion, or the malfunction of any other organ, torpidity of the liver, a deficiency of the excretion of bile, which is generally accompanied by constipation.

The Symptoms of Neurasthenia.—The symptoms are essentially those of chronic fatigue, which has become exaggerated and pathologic. They may be classified as sensory, motor, psychic, and somatic. The sensory symptoms first noticed are those of generalized fatigue, with such localized sensations as headache, backache, and limbache. The motor symptoms are muscular fatigue, muscular weakness, and muscular exhaustion on slight exertion. The psychic symptoms are manifested by a diminution in the capacity for sustained mental effort and the spontaneity of thought and exhaustion after slight mental effort. The somatic symptoms show themselves in atony of the digestive tract and the circulatory apparatus, with disturbances of the secretions.

Headache is one of the most common symptoms of localized fatigue, and, associated with this, may be a sense of constriction about the head, and there may be either a sense of lightness or fulness of the head.

A woman who is chronically tired loses all her personal vigor, force, aggressiveness, and, above all, will power. Associated with this lack of will power are hesitation, indecision, a marked irritability, and timidity. Neurasthenic patients are subject to spontaneous attacks of fear, causeless in origin, and generalized in character. These attacks may be accompanied by pallor of the face and palpitation of the heart, just as in normal fear. The tired woman is a cross woman. The irritability shows marked impairment of the power of inhibition.

The Rational Treatment of Neurasthenia.—First of all, there must be a removal of the cause which has produced it. There are two distinct classes of cases—the overworked and the idle. The first class, and the most important to the world, are the overworked. We may have to deal with the intellectually overworked, in which the

mental overwork was combined with financial anxieties, domestic difficulties, or lack of success in their work, or the cause may have been the tremendous responsibilities of their positions, which involved the lives or fortunes of many people. Added to this great strain and overwork, has been a lack of proper intervals for rest, recreation, and sleep, and the body has become a storehouse for various toxins, and so is suffering from both acute and chronic poisoning.

This class of patients must have the most rigid rest treatment, such as was prescribed by Weir Mitchell years ago. It is most important that the patient should be removed from her old surroundings; if this is not possible, she should be isolated on the top floor of the house with a good nurse. The room selected must be bright and cheerful, with plenty of sunshine and fresh air; a window should be open practically all the time, for oxygen and sunshine are two of the best restoratives. The diet must be easily digested and very nutritious. The patient should be urged not to use her mind at all. Carefully selected short stories may be read aloud by the nurse; the reading should not be continued for more than half an hour at a time.

A great deal may be done to eliminate these toxins from the system by the proper use of electric-light baths, followed by the shampoo and the percussion douche; massage with salt water, salt rubs, and electricity.

In most cases a month of this absolute rest is as long as is beneficial to the patient. And for most of them the seashore is the best. There should be enough going on to be diverting without being overtaxing, and a climate should be selected which is warm enough for the patient to live out-of-doors. There should be short walks, drives, sails, etc., and this outdoor life, with a contemplation of nature, is the most powerful restorative. The grandeur of nature, whether it is the mighty forests, with their refreshing shade and quiet, or even stretched in a hammock watching the sky and trees, or the constant surging of the vast sea, bringing rest in its unceasing restlessness, with

the ships sailing lazily along, until the whole fades away in the distant horizon. In the vastness of the universe, the *ego* becomes contemptibly unimportant and insignificant.

After several months spent in this way the body has gotten rid of its toxins, nerves and muscles are rested, and through the soothing influence of nature the neurasthenic is gradually trained back to a healthier habit of thought and a more rational frame of mind. There is substituted for the morbid emotional complex a feeling of pleasure and energy. Reason and judgment reassert their sway; outdoor life quickens the perceptions, and forms tranquilizing memory pictures on the brain that return later to solace and refresh the individual.

There is another, and a very large class, of cases among women of leisure who have suffered all their lives from a lack of a vocation; they have nothing to think of except themselves. They do not know what it is to be quite well; they travel from one part of the country to another, and from one country to another, but they never rise above a certain level of invalidism. They are self centered, and what they need is the work cure. In the majority of cases, before these patients can be restored to health, powerful habits must be eradicated, new interests in others must be supplied to supplant the most intense egotism, new paths must be hewn out in the brain, the will must be recreated, and character can only be imparted by those who possess it.

CHAPTER VII

THE HYGIENE OF THE MIND AND ITS RELATION TO THE PHYSICAL HEALTH

Heredity; Temperament; Social Instincts; Fear.

Mental Development; Self-control, the Moral Sense, the Religious Instincts; the Advantages of College Life; Balance of the Mental Faculties; the Effects of the Higher Education of Women.

The Environment; the Choice of Friends; Literature.

The Power of the Will or Inhibition; the Effect of the Mental Attitude on the Physical Health; A Definite Occupation a Physical Necessity; the Psychology of Success.

The solidarity of brain and mind is an axiom of modern medicine, and it is a fundamental principle that must be kept constantly in view in all physical and mental training. Hitherto unsoundness, inefficiency, and weakness of mind have only been lightly touched upon in preventive medicine, but the importance of the mind as the chief factor in health and disease is so paramount that it can no longer be ignored.

The problems that present themselves to the mother and the educator to-day are practically the same, and the mother is one of the most potent educators that we have—how the mind can best be strengthened, broadened, and be made the most efficient working instrument possible through the application of modern scientific and physiologic knowledge. These are questions of vital importance to the human race.

Heredity.—Holmes says: "Each one of us is only the footing up of a double column of figures that goes back to the first pair. Every unit tells, and some of them are plus and some of them are minus. We are mainly nothing but the answer to a long sum in addition and subtraction.

Slight obliquities are what we most have to do with in education."

There are certain hereditary predispositions that will develop under certain conditions; some of them are good, some are evil; that is, with the natural development of the mind, certain peculiarities of the ancestors will be reproduced. The problems suggested are how the mind can best be developed, educated, and trained, so that hereditary weaknesses may be counteracted or held in abeyance, and that latent hereditary talents may be discovered and developed.

The first proposition that we have to face is that like produces like. There are modes of education, of conduct in life, and of occupation that should be avoided where a boy or girl is handicapped by a bad heredity. There are special precautions and attention to physiologic laws which would save the minds of many young men and women with a bad heredity from passing into a state of inefficiency and actual disease. Heredity implies only potentiality toward good or evil, and the latter may be averted by knowledge and the proper practice.

Temperament.—This comprises the general make up of the individual, the shape of the head, the appearance of the eyes, the mobility of the features, the texture of the hair and skin, and the kind of movement. The recognition of the kind of temperament, and a suitable training for its best development, is of the greatest importance in attaining good health and success in life.

There are four general types of temperaments—the nervous, the phlegmatic, the arthritic, and the scrofulous or lymphatic.

The nervous temperament has certain marked characteristics, as the small, wiry figure, the well-shaped head, the bright, restless eye, nervous bearing, highly strung and sensitive nerves, feeling pain keenly and bearing it badly. This woman is imaginative, sensitive, fond of intellectual work, often artistic and ambitious. In her the brain and mind are dominant above all else. When

15

run down, this woman will be difficult to bring up again to the normal level. She will grow thin, dyspeptic, irritable, and often neuralgic. She will be peculiarly liable to nervous disorders.

This temperament has its special temptations—alcohol and sedative drugs are two of them. Alcohol is not taken steadily or for social reasons, but for the effect of alcohol on the brain, and there is the greatest danger of becoming addicted to alcoholic habits, and finally of becoming an uncontrollable dipsomaniac.

The phlegmatic or bilious temperament relates more to the training of the body, since in this class of cases the mind is not exposed to the same dangers, but the oversanguine temperament has its own dangers, which may lead to lack of effort, speculation, and financial ruin.

The arthritic have a predisposition to both rheumatism and gouty disorders, to which they are distinctly more liable than others, and the fact that there is this latent tendency should be taken into consideration during childhood and youth.

Social Instincts.—Social instincts lie at the foundation on which the family and community is based. It may be said that any individual who is destitute of them is in an abnormal condition, hence a right training of the social instincts is, beyond doubt, one of the most important means of securing happiness to the individual and order to society. The child's or youth's relation to others, her affection for others, and her altruistic practices, all go for the making of society, good citizenship, and patriotism in the race.

At the school age the social instincts are one of the strongest elements in life, and one of the most powerful adjuncts in developing mind and body. The cravings of young women for social amenities are stronger, and her deprivation of them more hurtful, than in the case of young men. There are few girls in whom it does not require some regulation. The strain of too much social life is injurious; social dissipation cannot be combined with school life without wrecking the health of the young

woman; nervousness, anemia, and mental depression follow.

That individual cannot be said to be healthy mentally whose social instincts are poor and perverted. Commonly one of the first symptoms of a disordered mind is the diminution of the social instinct. The insane are notoriously asocial.

Fear.—This is one of the most elemental and primitive of the emotions. Biologists assure us that fear and surprise were the first of the emotions to be developed, and that the feeling of the ludicrous was the last. Darwin says that the earthworm knows fear, and darts into its burrow like a rabbit when alarmed. So we see that fear is common to all forms of animal existence, even to the lowest. This universality of fear has come about through the working of the laws of natural selection, which prescribe that only those creatures shall survive that can best adjust themselves to their environment. Within limits, fear as a primary instinct has been and is eminently useful. It is the cry of alarm raised by the senses which act as guardians of the body, and, at a signal, in virtue of the nervous automatism, the organism is put in a position of defense. On the other hand, fear may serve to paralyze, as has been observed in the case of birds, many of which, though scarcely wounded by the small shot, fall to the ground as if struck by lightning, panting with wide-open eyes. In human life, while fear incites to activity, it may also paralyze that activity.

Mosso says that the fear that young children have of cats and dogs, before they have learned why they are to be feared, is a consequence of heredity. We are born to a heritage of fear. If we fear ghosts and demons less, we fear microbes and bacteria more. The professional or business man fears failure, but fear should be a guardian, not a jailer. A healthy fear of indigence will lead to thrift, industry, and such measures as will secure one's personal independence. Up to a certain point, fear is a protection, but beyond that it paralyzes.

Mental Development.—We note that at birth the brain is mindless, and that the brain-cells, which are the vehicle of the mind, undergo their greatest development during childhood from stimuli coming from without the body. The brain-cells possess infinite possibilities and potentialities. They are developed from the stimuli from without through the eyes, ears, touch, taste, and smell. There is another series of constant impressions which are received from within the body, and these come from the muscles.

These impressions, conveyed to the brain-cells from the body, and from the outer world beyond the body, leave a fixed registration, the writing on the brain-cells has begun, and this constitutes memory; and the imprint on these cells is similar to that which type leaves of letters and words on the page of the printed book. These printed impressions on the cells can be revived and seen and heard by the mental consciousness, just as a printed book can be opened and seen and read by its owner.

The natural qualities of the mind are imitation, acquisitiveness, emotionalism, and imagination.

The force of example in the home, at school, and in the book world is among the most potent influences in molding character. The young girl instinctively imitates her mother, her friends in real life, and in her book world, and the woman will be the composite production, combining traits of all of these, which will be ingrafted on the ancestral traits which have been inherited.

In young children it is difficult to decide where the imagination leaves off and the spirit of untruthfulness begins. In any case, the tendency to exaggeration and untruthfulness are so prevalent in childhood that it must be checked at the earliest signs of its appearance. The vice becomes so deep rooted that it affects the mind in all its workings and the entire life as well. It follows men and women into their business careers, their scientific life, and their professions.

Professor Swift, in a very interesting study of the devel-

opment of the mind, invokes the aid of biology to show that all children are but little animals, having no inborn notions of right and wrong, inheriting no sense of justice; savage, by nature, and predatory by instinct.

He finds a psychic justification for fighting among boys. "Fighting in some form," he says, "is one of the first means by which the mind becomes accustomed to intense action. To fight well, a boy must be capable of severe concentration of attention."

And he has found the age at which boys come to think that laws and the recognized rules of right conduct should be voluntarily respected varies from fifteen to seventeen years and older. These figures are approximately correct for girls.

Absolute truthfulness, square dealing, honesty, honor, and an *esprit de corps* should be demanded. Hitherto these principles have not been sufficiently inculcated in girls as the fundamental principles on which life must be met. The discipline has been too lax in the home and in the school; it is that of implicit and prompt obedience on the word of command; the proper subjection to and respect for those placed in authority; the kind of discipline given in business life, the hospital, and the army, and the lack of which has cost so much happiness and so many thousands of lives.

Self-control.—The perfect capacity for self-control in all directions and at all times is the ideal state at which we aim. It is the standard aimed at by developing the power of the will and the strength of inhibition. The great difficulties, the magnitude of the task, may be conceived of from the saying of the wisest of all men: "He who conquers his own spirit is greater than he who taketh a city." The reason is plainly evident—all the hardest battles of life must be fought out alone, there is a feeling of isolation, as if one were struggling alone against the combined forces of the universe, and, at the same time, there is going on the struggle for the mastery between the two conflicting natures, "When I would do good, evil is present with me."

Whereas, in concerted action there is a feeling of sympathy, of reinforcement from outside help, and the pleasant stimulation of competition.

If youth were taught that certain enemies were going to present themselves on the field, that they come for the most part in the first instance single handed, and if grappled with one at a time, and the contest between right, and perhaps inclination, be then and there fought to a finish, each successive time the conflict would be easier and the victory more certain; that in losing such a battle there must always be a certain loss of self-respect, a feeling of moral weakness, it may be even so slight a fault as the exaggeration of facts; while, on the other hand, a victory always gives something of the same feeling of exultation that one has in any fairly won contest or game. A feeling of pleasurable superiority, of having one's self well in hand. In the moral habits every gain on the wrong side undoes the effects of many conquests on the right. The training of the will becomes the most vital of all problems. Nothing that is learned in youth is really so valuable as the power and habit of self-restraint, of self-sacrifice, of energetic, continuous, and concentrated effort.

The Moral Sense.—From fifteen to twenty-five years of age is the most crucial period of life in regard to the hygiene of the mind. It is during this period that the brain first exhibits some of its strongest hereditary tendencies. While such mental factors in human life as conduct and character are being consolidated, as they now are, hereditary predispositions manifest themselves, telling for good or evil, for success or failure.

The acquisitions then made are critical in the extreme and often final. The real love of right, hatred of wrong, duty, conscience, religion, become solid and effective in forming character.

The emotional nature instinctively shows a leaning toward the opposite sex; love between the sexes toward the close of adolescence is the most intense and most unreasoning of human passions. The sense of right, wrong, and

duty become active principles, dominating the character, There are yearnings after the ideal, an intense scorn of and hatred of evil. The purposes in life are then shaped. The impressions and resolutions then formed affect the whole tenor of the woman's life, as a rule, more than at any other time.

The capacity to feel pleasure reaches its greatest intensity. The sex relations are built up on safe and natural lines, regulated by family life, social feelings, and the carrying of the thoughts and the emotions into other channels, controlled by certain instinctive natural tendencies, by morality and religion. To think and feel properly should mean to act rightly as a physiologic corollary.

Music, literature, and art, imaginative works of all sorts, mix themselves up with the sex feeling, so that the two help to form the emotional nature. Far-away glimpses of poetic feeling, pleasurable altruism, citizenship, and patriotism show themselves in the earlier stages and give direction to life in the later. The whole period is one of immense importance for the health and happiness of the remainder of life, and the risks to the body and mind are then very great. A fact which is of great importance, and which is especially true of adolescence, is that it is possible by undue pressure to use up stores of energy that should have been spread out over very long periods. Through such overexertion in study or in games too heavy a drain is made on futurity, and mental disorders at this time are by no means infrequent, mental depression being generally the first to appear. This is more especially true in the descendants of neurotic families. The subjects are troubled with neuralgias, insomnias, and there is a pessimistic view taken of life.

The Religious Instincts.—Möbius says, "We reckon the downfall of religion as one of the causes of mental and nervous diseases. Religion is essentially a comforter. It builds for the man, who stands amid the evil and misery of the world, another and fairer world. Besides his daily careful life, it lets him lead a second and purer life. The

consciousness of being within the hand of Providence, and the confident hope of a future redemption, is a support to the believer in his work and care, for which unbelief has no compensation. Meditation calms and refreshes him like a healing bath. Worship breaks in upon the daily drudgery of his days with rest and meeting." The morality of a nation suffers most severely through the downfall of its religion, as experience has always and everywhere proved.

The religious instinct has a very close relation to the emotions, morals, esthetic feelings, to social instinct, and to sex. The feelings of reverence and awe, and the consciousness of the infinite in man are vague, but are the most powerful parts of his nature.

Religion furnishes the only pure ideals that half of the world has access to. It has proved an intellectual stimulus, and roused a metaphysical frame of mind in some of the most vigorous nations, such as the German and Scotch. It leads more toward refinement of life than any other agency. It stimulates the benevolent and altruistic feelings, and leads to their practical demonstrations; it fights vice and immorality; it seizes on the best that is in man and transforms the character.

The Advantages of College Life.—College life is of the greatest possible advantage to girls in many ways: it is broadening to the mind; discipline is maintained, and, at the same time, the girl is thrown on her own resources; adequate means are provided for developing both mind and body to their greatest capacity.

Whether the girl comes from the country, a country town or city, her social group is comparatively limited; her world is very little and the *ego* is very large. The discipline that any large body of students bring to bear on the conduct and behavior of the individual is one of the important advantages of a college training. The insignificance of the ego, who is only a unit in this large community, is quickly impressed on the gray matter of the brain, and the rough and unpleasant angles are soon

smoothed off. This, in addition to the discipline afforded by the college officers, and the total lack of discipline is the weakest point in the average girl's education. To be brought into intimate relation with the members of a large and educated community is in itself a liberal education. To learn to respect the rights and the opinions of others, to perceive that any given subject has a great number of points of view, is attaining toward a healthy mental balance that will make the woman broader minded, more sympathetic, more companionable, and more charitable in her views of life.

In addition to the regular college curriculum are the opportunities afforded, not only to special students, but to the entire body of students, for a liberal education in music and art, and so a broad foundation for general culture is laid that will greatly increase the opportunities for pleasure all through life.

So that, in addition to the actual knowledge acquired by a college education, there are also the advantages of the discipline of and development of mind and body; the knowledge of how and what is worth while to study; the power to study and solve life's greatest problems for herself and those dependent on her; the firm muscles, the clear brain, the steady nerves, the power of judgment, the control of the will, and the formation of character—on all of which the ultimate happiness and success in life depend.

Dr. Beard gives to brain workers a value of life of fourteen years above the average. The brain-working classes are less apt to worry, less apprehensive of indefinite evils, and less disposed to magnify minute trials than those who live by the labor of their hands.

Spinoza says that every advance toward perfection gives us happiness, and it is safe to say that the buoyancy which characterizes contemporary thought, the hopeful outlook amidst the dangers which threaten us, the sense of the added cubit to the man's stature, are due largely to the recognition of the power for good within his soul of which he was not formerly aware.

Balance of the Mental Faculties.—There must exist a certain balance between the various faculties of the brain in order to insure sanity. A high order of intelligence without much will, or keen emotions without a corresponding power of inhibition, and overmastering will and slight moral sense, vivid imagination without common sense, intense social instinct without much conscience, fervid religious instinct without much sense of duty or altruism, must invariably produce one-sided and unbalanced individuals, and the results would be bad for society; and too many of these one-sided or unbalanced people would impair if not endanger the safety of the State.

Excessive ambition, misdirected energy, longing for the unattainable, regret for the unalterable, anticipation of future unhappiness, lack of a sense of perspective, fretting over non-essentials, indecision, reopening of troublesome questions already settled, avarice, selfishness, excessive emotions, uncontrolled passions, and the actual cultivation of the melancholic state are some of the causes of mental anguish and subsequent physical suffering.

Well-balanced mental faculties give a philosophic view of life; guard the mental and hold the emotional in check; grasp the true relationships in life, and view it in the proper perspective.

The Effect of the Higher Education of Women.—Nothing is so convincing as actual experience and statistics;[1] and nothing is so broadening to the mind as the study of history.

Never before in the history of the human race has any such large body of young women been given the educational advantages for the development of body and mind which they enjoy to-day. From antiquity there have been exceptional women, who were highly educated and cultured, as in Alexandria, Athens, and in the old European universities, but up to the present day any tendency toward the education of the masses of women

[1] "Education as the Controlling Factor in the Physical Life of Woman," Four Epochs of Woman's Life.

has been looked at askance, and in this respect the position of the people of the United States was long peculiarly provincial.

To two men belong the great credit and honor of conceiving the idea of a liberal college education, and a medical college training, for women in this country.

In 1865 Mathew Vassar, "having recognized in woman the same intellectual constitution as in man," founded a college for women only, and thus gave women the opportunity for the same education that young men enjoyed at their colleges.

In 1850 the Woman's Medical College of Pennsylvania was incorporated. The idea of establishing a college for the medical education of women originated with Dr. Bartholomew Fussel, of Chester County. The query arose in his mind, "Why should women not have the same opportunities in life as men?"

Just how strong the public sentiment was against these movements, and the leaders of the opposition comprised the most prominent educators and physicians of the day, and what impediments they placed in the way, it is now difficult to realize.

The opponents of the higher education of women urged three final objections: First, women were mentally incapable of receiving the same kind of intellectual education as was given to young men at college. Second, they lacked the physical endurance to bear the strain of mental work. And, third, such an education would render the young woman masculine—she would no longer be willing to look after the ways of her house, her natural affections and power to love would vanish, she would become unwilling to marry and bear children.

Ex-President Eliot, of Harvard University, who has so long been the great educational leader in this country, in his paper on "The Higher Education of Women," says: "During the past thirty-five years three distinct apprehensions concerning the effect of the higher education of women seem to me to have been removed. In the

first place, there was a perfectly sincere doubt (because there was little experience to go upon) whether young women were so capable as young men of receiving what was then called the higher education; or, in other words, whether the young woman had the capacity to master by study the traditional subjects of the higher education. That doubt has been completely removed.

"Secondly, it was feared that if the young women studied in the colleges three or four years, beginning at about eighteen years of age, that such study would have serious effect on their health and on their fitness for their natural functions in after-life. This apprehension was felt by many physicians and was warmly expressed. For a whole generation we have been trying the experiment, and the result is perfectly clear. These apprehensions have not been justified. It is apparent that young women can do much mental work for three or four years between the age of eighteen and twenty-two, not only without impairing their physical vigor, but all the time improving it, if they live wisely and under right conditions.

"And thirdly, there was the strong apprehension felt by many excellent people, lest in the process of the higher education young women would be denatured. They admitted that young men were not denatured in any way by the higher education at college, but they thought that there was a serious chance that young women would be altered in their feminine nature by the process of education. It has turned out that a young woman who studies in college, from the age of eighteen to twenty-two, is no more altered in her nature than a young man is who goes through a similar process. It takes a great deal more than that to alter the nature of a woman.

"I suppose that this apprehension was based on the fact that women seem, to men at least, more tender, fragile, and delicate than men, and, therefore, more liable to be bruised or coarsened than men; it was feared that the kind of public life, so to speak, in large groups would

have some tendency to deprive them of their natural delicacy, refinement, and tenderness. It has not turned out so, and everybody recognizes that it has not turned out so."

When higher education, the professions, and industrial pursuits are all unquestioningly thrown open to women, then it can be reasonably supposed that they will come to possess those traits of mind—judicial, logical, creative, etc., now generally considered as masculine traits, and they will not only be more attractive and companionable for their husbands, but will be far more competent teachers for their children, their enlarged range of thought and vision inspiring greater confidence in their sons, and stimulating higher ideals in both sons and daughters.

The Environment.—As we have seen, the brain registers every impression from within and from without; if the impressions are those of discomfort, gloom, darkness, ugliness, those things, being inharmonious to the constitutional working of the brain, do harm and tend to set up bad habits. First, the body must be healthy, and the environment good in order to insure a healthy, vigorous mentality. Too much thought and care cannot be given to the environment of the child, youth, and adult.

Careful attention must be given to the toilet. The quality and condition of the underlinen, the cut and fit of the clothes, all tell on the mind. It has been said that a man tries to live up to his clothes; hence, the uniform of the soldier and the cassock of the priest. Clothes are not only an index of the character, but they help to make it. The clothing that comes into intimate contact with our bodies has a soothing or irritating effect upon the mind. It has also been said that for a woman to know that she was properly dressed had a soothing influence on the mind, second only to that of religion itself.

In the evening, laying aside the business suit of the day with all the anxieties and dust of toil, and replacing it by a tasteful house-gown, brings a sense of freshness that brightens the mind and stimulates the appetite.

The clothing should always be suitable to the employment, to the purse, and to the surroundings, or good taste is violated, and, again there is an unhealthy reaction on the mind.

To live in a gloomy house, with a dull ugly wall-papers, and no sunshine entering the room, may produce in their inhabitants want of appetite, interfere with nutrition, make them gloomy, unhappy, and hard to live with. While esthetic surroundings render life happier, brighter, and higher.

If one cannot afford expensive paintings to hang on her walls, she can select photographs of the old masters, neatly framed, which, placed in harmonious surroundings, elevate the mind, cause a love of the beautiful, develop the taste, and lay the foundation for a broad culture that will increase the enjoyment of nature as well as of art.

The Choice of Friends.—We have seen that the impressions conveyed to the brain-cells leave a fixed registration and are indelibly stamped there. These may be called the sensitive plates of the mind, and it is because of this writing on the brain that the selection of our friends and associates is a matter of such vital importance.

The subconscious mind, of which we hear so much to-day, does not originate thought; it can only elaborate and develop it, and the most important fact which has as yet been discovered in regard to the subconscious mind is that it is suggestible; that is, it is subject to moral influence and direction. A few words of commendation and praise brighten the whole day; if we can forget our pain for a little while, it is apt to cease.

All our greatest intellectual leaders, from time immemorial, have been unanimous in their teachings that one of the most important elements in the molding of the mind and character was the nature of our friendships. Tennyson says, "I am a part of all that I have met." "A man's friendships shape his life more than aught else, or more than all else." The immortal bard puts it, "It

is certain that either wise bearing or ignorant carriage is caught, as men take disease of one another; therefore, let men take heed of their company." And again, "'T is meet that noble minds keep ever with their like, for who so firm that cannot be seduced?"

Certain requirements and standards should be met, and the girl or woman should be sure that the individual, whether man or woman, comes up to the standards of her own clan.

A friend should be congenial, with similar tastes, opportunities, and training; frank in criticism, yet sympathetic in spirit; loyal and staunch in adversity, and one who disseminates an atmosphere which is broadening, elevating, and uplifting. Such a friend is to be desired and to be sought after.

Literature.—Not one of the least of the great molding influences on the mind and the social life of to-day is its literature, and the form of this which reaches the greatest masses of the people are the daily press, the literary magazines, and the modern novel. It is scarcely possible for the young to conceive the great impression which is made on the mind and character by the kind of books which they read. Carlyle said, "We cannot look however imperfectly upon a great man without gaining something from him." And to this statement might well be added, it is impossible for the mind to be brought into intimate contact with the lives of dissolute men and women, so vividly portrayed in many of the novels of the day, without being smirched by it. It is no more safe to read such a class of books, hoping to escape contamination, than it would be to live in the malarial districts of Africa, and hope to escape contracting that insidious disease.

However limited the geniuses may be in our immediate circle of friends, each of us may have for her most intimate friends the greatest geniuses the world has ever known, and have them at their best.

Two axioms should always be kept in mind—a real love

for books is formed in early life or not at all, and to have books for friends one must own them, have them on her own shelves, to take down and put up at will, to mark, to compare, and study. So whatever else one lacks, she should always have her own library, even if it is a limited one.

Next in importance to the recognition of good reading must necessarily be a recognition of the limitations of one's reading. Whether in the capacity of student, housewife, mother, or business woman, the time that can be devoted to general literature is very limited.

A careful study of history and biography should always precede fiction. It is a fundamental part of a liberal education to know something of the world's history, and the history of the English nation, as well as the biographies of the men and women who were such important factors in making its various epochs.

This should be followed by a study of the classics, and that education has not been liberal which has not included a study of the modern classics. German literature opens up a new and delightful world. A study of the classics forms the taste, elevates the mind, broadens the vision and the power of judgment, and it is a profound help in the formation of character. After such reading as this, who would be willing to spend her time on the cheap and trashy novels of the day.

Good modern fiction should be taken up as a recreation by the woman whose life is laborious, its questions perplexing, and its complications tiresome; in other words, after the woman has left the high-school or college and has entered on her life's vocation. For young girls, not only is too much time apt to be given to fiction which should be devoted to other and more important matters, but it is apt to do much harm by giving them a wrong impression of life.

The Power of the Will or Inhibition.—The conduct of mankind is chiefly governed by the emotions, instincts, and impulses. Spencer traces all human action to the

desire for pleasure in the large and philosophic sense of the term. If this be so, then the education and hygiene of the emotions and impulses must be of the very highest importance in the life of each individual and in the social world. The question arises, and it is all important, can those inhibitory centers be so developed in youth, and so cultivated in life, that they can act as antagonists to what is morbid? Can they be used as direct preventive and curative agencies against tendencies and impulses which are foolish and hurtful? And the answer of educators, as the result of large experience and observation, is emphatically, yes.

But the training, to be efficient, has to be systematic, persistent, and along well-defined lines. The first step in this training must be the strict avoidance of all that has a tendency to lower the standards of morality, whether this is in the line of companions, literature, the stage, music, or art. To do otherwise is not brave, but as foolhardy as it would be for a weak army to advance against a powerful foe; it means annihilation or to be taken prisoners of war.

To overcome obsessions and delusional beliefs by volitional effort, the effort should be made to direct the mind to other subjects which have nothing whatever to do with the obsession, rather than to make a direct stand of the will against it, since the will may put forth its utmost strength in the way of direct repression of the temptation to any immoral action, and may entirely fail, while, by directing the same amount of force in changing the direction of thought, complete success may be attained.

The influence of the will upon the emotions is a matter of the highest importance in regard to the direction of the current of thought and the determination of actions. Control your passions; govern your temper. We can no more avoid feeling mentally hurt than we can feeling physical hurt, but we have exactly the same power of the withdrawal of the attention from the mental hurt as from the

bodily pain, by determinately fixing it upon some other object.

"I am, I ought, I can, I will," are, as has been well said, the only firm foundation-stones upon which we can base our attempts to climb into a higher sphere of existence. The first implies a faculty of introspection, the second a moral judgment, the third a consciousness of freedom to act, the fourth a determination to exercise that power.

The influence of the will on the conduct is first automatic, through previously acquired habits; second, through the emotional state, and third, by our notions of right and wrong. In the fundamental principles of living must be included a genuine consideration of the right of others. The memory is an automatic reproduction of ideas, the mechanism of recording processes.

The education of the will, the power of breasting the current of the desires, and doing for long periods of time what is distasteful and painful, all tend to increase the power of inhibition and strength of the will. Nothing that is learned in youth is really so valuable as the power and habit of self-restraint, of self-sacrifice, of energetic, continuous, and concentrated effort.

Seneca claims that difficulties strengthen the mind as labor does the body. Plato said, that "self-conquest is the greatest of all the victories."

Character lies preëminently in the sphere of the will, and anything which weakens the will saps the worth of life at all points. The strength of will bears not only on character, but on happiness and influence as well. The leader must show reserved power, and make it plain that she has herself well in hand, to secure confidence. "Will makes men giants."

The Effect of Mental Attitude on the Physical Health.—The ordinary operations of the mind have little effect on the physical condition, but such emotions as fear, worry, anxiety, grief, despair, anger, hatred, and the like depressing emotions act directly upon the muscular and

nervous mechanisms, profoundly affecting the secretions and the excretions, and stamp themselves upon the very tissues of the organism.

Of all the mental attributes the emotions are the most exhausting. A woman can spend more of her strength in five minutes of unnatural excitement than in a day of calm, steady brain work.

A perfect temper is not only a prime requisite for a club president, but for every man and woman in this hard workaday world, with its fierce competitions, its petty jealousies, and the stiletto practices of the cowardly, and it is one of the greatest preventives of indigestion, insomnia, and nervous prostration.

Forget your grievances. Every time that one repeats them to herself or to a friend she lives them over again, and the original trouble was but the merest moiety of suffering compared to a wound torn open afresh every day. To cherish a vindictive spirit does a vast amount of injury to the possessor of that spirit. In view of the facts of the beneficial effects of fighting upon small boys, and that the combative propensities of the Irish peasant commonly evaporates with his shillelagh, it would seem commendable to introduce boxing matches among women as a way to settle their differences.

From the standpoint of health, the intense excitement attendant on playing for high stakes, the loss of sleep, the unnatural life, the loss of money that one can ill afford to lose, must eventually lead to a serious if not to a fatal breakdown.

It is not the natural and reasonable intellectual work that injures the brain, but the various emotions—ambition, anxiety, disappointment, the hopes and fears, the loves and hatreds of our lives—that wear out the nervous system and endanger the balance of the brain.

Powerful emotion is like concentration attended with dissociation, it occupies the mind to the exclusion of all else, even to the dictates of self-preservation and reason.

The will is more or less suspended and held in abeyance during the emotional states.

The too great concentration of the attention on one's business or occupation is a self-indulgence that often ignores the importance of the lighter side of life and the legitimate claims of family and friends.

Less ambition and more philosophy would greatly lessen the number of cases of nervous prostration and allied neuroses. All of one's fortune is not staked on one throw of the dice; if the woman fails in one direction, there are other resources left.

Concentration of the mind on the physical suffering leads to the so-called habits in disease; there may have, in the first place, been a real physical cause. For example, in case of injury to a limb followed by severe pain in that member it has happened that after amputation of the limb the consciousness of pain persisted in the brain. In the functional neuroses, the first cause may have been a real physical one, but the individual becomes so self-centered, it is with difficulty that the mind can be withdrawn from the ego, and a cure can only be effected by supplanting the intense egotism by new interests.

Medical literature contains numerous observations of ailment caused by fright, and even of death itself so caused. It is not uncommon for medical students to contract the disease about which they are studying. In the old small-pox epidemics it was a very generally observed fact that those who feared contracting the disease were the most apt to get it. The reason is very easily explained —fear so suppressed the functional activities of circulation and nutrition, as to predispose the individual to take any disease to which she was exposed.

Autosuggestion is the predominant element in the concentration of the thought on one particular subject, and of the narrowing of the perspective to a single point of view.

Prolonged anxiety or grief will cause an emaciation, second only to that of tuberculosis itself, by the depression

of the heart's action and the circulation, the loss of appetite, the interference with nutrition, and the loss of sleep.

Worry is, as we have seen, in the first instance most frequently bred of exhaustion, but, if indulged in, it readily becomes a fixed habit, and the mind rapidly settles into a state of fixed gloom.

Worry is a type of fear. It is a futile regret over past mistakes and the miserable forecasting of the future. It has been called the great shortener of life under civilization—of all forms the financial one is the most frequent and, for ordinary minds, the most distressing.

Anxiety and the anxious frame of mind is in readiness to take fright in connection with our most vulnerable points on all occasions of apprehension or uncertainty. As no one's future can be clear throughout, there is never wanting the matter of anxiety to a mind susceptible of this state.

It is a significant fact that our asylums are recruited from the classes who spend their lives amid narrow monotonous surroundings; hence the large proportion of women, especially of farmers' wives, whose lives are probably the most narrow and the most monotonous. From this result the fixed ideas, the obsessions, and all the absorbing egotism of insanity.

With a variety of valuable and permanent interests, the mind is well safeguarded against attacks of worry. The overworked woman should increase her recreations, leave home for short intervals, travel, and have entire rest and change of scene. With increased vigor of body will come increased power of the will and the capacity to abolish worry.

Anger floods the brain with blood, and if the arteries are brittle, as they are in old age, and the individual is just as old as her arteries, the rise in arterial tension may result in the rupture of a blood-vessel, and the subsequent hemorrhage into the brain may cause an attack of apoplexy, paralysis, or even death. Attacks of anger

hasten the deterioration of the arteries; in this way anger has been known to cause death.

Every violent physical sensation will react on the lungs; every powerful normal emotion, whatever its cause, will also make its influence felt on the respiratory functions. An exercise which is performed with tranquil breathing if the mind is free from care, quickly produces respiratory disturbances if the mind is brooding and preoccupied. Those who have acted as seconds in a duel to men accustomed to the use of the sword know that they become breathless in the duel much more quickly than they do in the fencing school.

Depressing emotions make themselves felt in the respirations of animals as well as of man. A sensitive horse, which is badly used at its work, or even roughly spoken to, rapidly becomes breathless.

The dog is incomparably less swift than the hare, but is able to catch it; the fright of the hunted animal disturbs its breathing and robs it of much of its strength.

In fright the disorder of the respiratory movements destroys the regularity of the interchange of gases which takes place in the lungs, between the venous blood and the atmospheric air, and thus profoundly hinders the function of the aëration of the blood.

The more impressionable the subject, the more easily do the emotions influence his respiratory actions. Hence, the superiority in certain bodily exercises of men whose minds are calm and masters of themselves.

Emotional causes, such as worry, anxiety, and grief, as well as the more tangible physical factors, cause softening and disease of the tissues, which frequently accounts for the arteriosclerosis and premature senility. Alienists have long found abundant evidence that abnormal physical conditions are capable of producing mental diseases, but the reverse is quite as true.

And not only the imagination, but the intellect, the emotions, and the will have or may have a powerful influence over the sensations and organic functions.

It is not only profoundly true that mental attitude has much to do with bodily function, capable of producing changes in its nutrition and secretion, but we may go further and say that healthful and hopeful habits of thought do much to put the body on the defensive against the assaults of disease.

Mental attitude refers not to the will or the emotions, but to the mind in its entirety. The trend of a woman's thoughts, the use she makes of her intellect, the strength of the volition, the sense of responsibility, and the objects of her life are all questions that have a distinct bearing upon the bodily functions and the health of the individual.

A Definite Occupation a Physical Necessity.—It is now generally conceded by the leading sociologists of the day that women who are not engaged in the duties of maternity need the same intellectual and industrial activities as men. Many go further, and it is their opinion that there is no reason for excluding women, who are fulfiling the duties of maternity, from exercising full intellectual and physical activities in other directions. And the proof that this is not a mere theoretic assumption is to be found in the fact that many women have not only given birth to a family of children, but have successfully reared them, and, in addition, have been eminent in other pursuits and callings. Well-known illustrations of this fact are to be found among the most noted sovereigns that Europe has ever had—Catherine de Medici, Maria Theresa, Catherine II of Russia, and Queen Victoria.

Pleasure seeking, as the end and object of life, leads to ennui, disgust, and physical and mental deterioration, while the slavery of housework, the childish vanities, and petty cares and vexations are most injurious to the nervous system, so that for the life of the housewife the education preceding it should be broad; and the more highly educated the woman is, so much the more effectually can she free herself from attaching too much importance to every little detail, and so neglecting what is higher and more important, and it will be a great preventive of irritability of

temper, quarrelsomeness, and even melancholia and mental derangement, from which so many of these women suffer in consequence of the monotony of their lives.

Every girl when she leaves school, which she should consider the very alphabet of her education, should prepare herself for some definite occupation, just as her brother does.

Clouston, in answer to the question as to how the powers of the mind can best be developed, conserved, and made the best use of for life's work, says: "It is a most fortunate thing, if, during the later period of adolescence, an occupation in life has been selected which really suits the capacity of the individual and goes with his innate tendencies. The seriousness and the settledness of the life of the period, with the bracing of every nerve and sinew to do the work, to gain a reasonable position in society, and to enjoy a fair amount of happiness, is in itself a tonic of no mean value, while overtaxing of body and mind is always a risk, as well as an ambition which overreaches itself. The repressions of woman's life in civilized society constitute one of her serious strains and dangers. The life and conditions of a working woman who has six or seven children in a few years, who has small means, and but little help, is in my judgment the very hardest of any human being in our modern social system."

Thomas[1] thus sums up his views as to the evils resulting from the non-occupation of women of the better classes. "Human nature was made for action; and perhaps the most distressing and disconcerting situation which confronts it is to be played on by the stimulations without the ability to functionate. The mere superinducing of passivity, as in the extreme case of solitary confinement, is sufficient to produce insanity, and the emotion of dread or of passive fear is said to be the most painful of the emotions, because there is no possibility of relief by action.

[1] "Sex and Society."

"The American woman of the better class has superior rights and no duties, yet she is worrying herself to death; not over specific troubles, but because she has lost her connection with realities. Many women, more energetic and more intelligent than their husbands or brothers, have no more serious occupation than to play the house cat, with or without ornament. It is a wonder that more of them do not lose their minds; that more of them do not break with the system entirely, is due solely to the inhibitive effect of early habits and suggestions.

"The remedy for the irregularity, pettiness, ill health, and unserviceableness of modern women seems, therefore, to lie along educational lines. Not in general and cultural lines alone, but in a special and occupational interest and practice for women, married or unmarried. This should preferably be gainful, though not onerous or incessant. Normal life without normal stimulation is impossible, and the stimulation best suited to the nervous system is some form of interesting work."

The Psychology of Success.—Success has been defined as the accomplishment, the realization of what has been willed or wanted, the ripe fruition of the well-tended tree. The achievement of fame or fortune is what the world generally regards as success.

Before entering on an enterprise, all the premises in the case must be had in order to form correct judgments, otherwise incomplete and imperfect knowledge of the case will lead to error in judgment, in which there could be said to be "no *chance* of failure, it was a certainty."

An element that always makes for success is to be able to supply a want of the public; it is partly a question of demand and supply. It is sometimes possible to create a demand. But, as a rule, success is the fruition of patience and well-directed energy.

There is nothing which tends so much to the success of volitional effort as the *confident* expectation of its success, while nothing is so likely to induce failure as the appre-

hension of it. Since the tendency of the cheerful and joyful emotions is to suggest and keep alive the favorable anticipations, while that of the depressing emotions is to bring before the view all the chances of failure, the former will increase the power of volitional effort and the latter will diminish it.

The mental condition also exerts a direct influence upon the physical powers, through the organs of the circulation and of the respiration, the heart's impulse being more vigorous and regular, the aëration of the blood being more efficiently performed, in the former of these conditions than in the latter.

Success too easily won, or won early in life, may really be a cause of failure, because, having been once achieved, the individual may be content with what she has and not proceed to higher development. And so a very inferior success may be the tomb of energy and the satisfied goal of ambition, instead of a stimulus to higher things.

Lack of success may also be caused by indulgence or lack of courage, the individual preferring to sail along the chartered course of mediocrity rather than to strike out a new path for herself, involving risk, anxiety, and endless work.

And perhaps jealousy in the rank and file of the lazy, indifferent, and mediocre far more often impedes effectually the road to success than is dreamed of, so that a greater degree of secretiveness, warding off the scent, of the intentions, the aspirations, and the methods of work, until the object shall have finally been achieved.

Another and most important secret of success is to recognize failure as only a stepping-stone to higher things. Eggleston says, "Persistent people begin their success where others end—in failure."

The people who succeed in this world are the people who get up and look around for the circumstances they want; if they cannot find them, make them. "Circumstances," said Napoleon, "I make circumstances."

There are four mental requisites necessary to the achievement of success, namely: a clear view of the end; a judicious indifference to the sentiment around by the sweeping away of obstacles; an indomitable energy; and the power to resist the temptation to rest on the soporific plane of mediocrity.

CHAPTER VIII

DRESS THE FUNDAMENTAL CAUSE OF WOMAN'S PHYSICAL DETERIORATION

The History of Woman's Dress; the Corset in History; the Crusade Against the Corset; the Influence of the Corset on the Female Body; the Curved Front Corset; the Relation of Corsets to Abdominal and Pelvic Disorders; the Effects of Corsets on the Muscles; the Straight Front Corset; the Abdominal Corset; the Wearing of Corsets by Young Girls; What Style of Corset is the Least Injurious. the Shoe; the Stockings; the Essential Qualities for Winter Underclothing; the Length of the Walking Skirt; the Winter Street Dress.

A CAREFUL study of the history of woman's dress affords a forcible demonstration of the fact that the fundamental cause of the inferior physique and lowered vitality of the modern woman of civilization is to be found in not only her own, but also in her female ancestors' unhygienic mode of dress for many centuries.

Study the physique and dress of the ancient Greeks, then follow the history of dress down through the Middle Ages and the Renaissance to the present time, and, if further proof be needed, visit, as has been done, the savage races of the earth to-day, and behold women of powerful and classic physique still exist in lands where the body is not molded according to the barbarous decrees of the "modiste of fashion."

The History of Woman's Dress.—The history of Greek costume is for the most part free from what is known as change of fashion, for the reason that the Greeks did not attempt to reconcile the two opposite principles of covering, and at the same time displaying the figure; that is to say, of cutting the dress to fit the body.

The dress of the Greeks, when at the height of their civilization—and that of the Assyrians, Egyptians, and

PLATE II

Greek costumes. "Queen and two attendants."

ancient Romans was not essentially different—was very simple. It often consisted of a simple garment, the tunic, which pleased the eye by the gracefulness of its drapery, and at the same time was comfortable by reason of its looseness.

The chief and indispensable article of female dress was the *chiton*, or tunic, consisting of one piece of material, sewed together in the form of a sack, open at top and bottom, in height reaching from the neck to the feet of the wearer, and in width equal to that of the extended arms. Within this stands the figure, and first it is girt around under the breasts by a girdle, to keep it from falling; next the upper edges are fastened together on the top of the shoulders by a brooch, and the arms are either left bare, pressing down into folds at each side the masses of material, or these masses may be gathered around each arm, and fastened down the outside with buttons and loops, so as to form sleeves.

To secure greater warmth on the breast and shoulders the chiton was made long enough to be doubled back at the top, and this part reached to the waist. Underneath the chiton was worn a band of cloth, to support the breasts, and, in addition to this, a cord was sometimes crossed round the breasts outside the chiton, to assist either in supporting them or in bringing out their form. Round the loins was sometimes worn either a short petticoat of thick woolen stuff or a sort of bathing drawers, such as acrobats wore. This was all of the essential dress for indoor wear. The chiton was made of a variety of fabrics, though generally of linen.

For outdoor wear was the *himation*, a garment also worn by men; it was made of woolen stuff and was worn like a plaid.

The chiton and himation, as above described, continued to be the standard dress from 450 B. C. onward.

The hair was most usually worn gathered back from the temples, and fastened in a knot behind by hair-pins of ivory or bone, either plain or mounted with gold.

For the feet, sandals were usually worn, in exceptional cases shoes, and for hunting, high boots. Gloves were never worn by the Greeks, except to protect the hands in working.

From the time of Pericles, the great European distinction between male and female dress consisted in the length of the skirt, old men, priests, and officials being allowed the privilege of wearing long or women's skirts, and young girls being permitted to wear the short or man's skirt. Among the Romans, this single garment, worn by both sexes, was called the toga.

As time rolled on, this loose cord, which had formed the girdle, was reinforced by a broad belt or band to support the breasts. Among the Assyrians this belt was made of stiffened linen or thin metal; the Egyptians wore a folded belt; a broad belt for supporting the breasts was also worn by the Roman ladies. But whatever the material used, this stay-belt does not show any signs of tight laces or of vertical ribs of iron or bone. It was, however, the forerunner of "stays," and when the moral fiber of the Greeks grew lax, the courtesans set the fashions, and dress was used to display rather than to conceal the figure, and, in order to make the hips more prominent, the waist was constricted by a many-layered belt. At the same time, the use of cosemtics was introduced.

The Mediæval or Middle Ages.—From the end of the fifth century to the beginning of the seventeenth there was a singular resemblance in many marked particulars between the dress of the two sexes. It now became the object of dress in both sexes not merely to clothe the person, but also to display the figure and adorn it. In the temperate climates there are always greater changes in fashion than in the very hot or very cold.

Subjugation by the Romans in the first centuries of the Christian era was followed by a general conformity to their mode of dress, so that the Roman dress may be considered to have become European.

In marked contrast to the loose, flowing robes worn by

the southern nations of Europe in their decadence were the short skirts and jackets clinging to the limbs, which were worn by the hardy nations of the North, who were given to constant fighting and the pursuit of the chase. The Norman lords, following the fashion of the south, swept about in long tunics and flowing robes.

In the twelfth century the Anglo-Saxon women, dressed in their loose garments, were indebted to the Norman ladies for the introduction of "stays," and the fashion of tightly lacing the body with a robe, laced down in front in order to show its undulations, as well as the use of cosmetics.

In the household register of Eleanor, Countess of Leicester, which bears the date of May 24, 1265, is one of the earliest places in which the word *corset* occurs. The word is again found in reference to the wardrobe of Richard King of the Normans, and Edward his son. Corsets were at this time worn by men as well as women.

The author of the life of St. Thaïs, who lived in the twelfth century, tells us that the French were so tightly laced that they could bend neither their bodies nor their arms.

Peter the Great wrote that the robes are so tightly stretched over the body, that the ladies can scarcely breathe in them, and often suffer very great pain in order to make their bodies slender.

It was in the thirteenth to the fourteenth century that the last trace of the Roman drapery gradually disappeared: the women adopted for the most part the robes with the tightly fitting corsage, leaving ordinarily uncovered the neck and the skin of the breast; this closely fitting corsage was closed in the back by lacing.

Boots and shoes of this period had their pointed toes made two or three times the length of the wearer's foot. The fashions of England were the same as those of France, though apparently they were not carried to quite the same excess as on the continent. The singular aim of each sex was not only to emulate the other in the sumptuous style

of dress and its profuse adornment, but also to imitate the form and fashion of the other's attire; this obtained in both countries.

The Renaissance.—In the sixteenth century a distinct separation between ancient and modern dress took place, and our present fashions took their origin from about that time. It was during this century that men adopted clothes closely fitting about the body, overcoats with tight sleeves, felt hats with more or less rigid brims, and closed boots or shoes. The women also wore their dresses tightly fitting to the figure, with tight sleeves, low-crowned hats, and richly trimmed petticoats. These garments, which differ wholly from antiquity, constitute, as it were, the common type, from which has risen the endless variety of modern male and female dress.

At this time the general resemblance between the clothing of the two sexes, which may be traced to the earliest times, became decided. After the accession of Queen Elizabeth in 1558, the well-known costume, associated with herself from about the middle to the close of her reign, gradually became established. The long-peaked and tight stomachers of the ladies, and the padded quilted doublets of the men—it might truthfully be said that each garment was a parody of the other.

Ruffs of an exaggerated amplitude and of a painfully severe stiffness were worn by both sexes.

At the beginning of the seventeenth century the dresses were tight at the waist, but begun to be made very full around the hips, by means of large padded rolls, which were still more enlarged by a monstrous arrangement of padded whalebone and steel. To both boots and shoes high heels were added, in place of the flat heels previously worn.

About 1710 the hooped petticoat was introduced, and about 1740 they obtained enormous dimensions.

When traced to their original sources, we find that all of the extremes of fashion were made to conceal some deformity of the figure, or to give to a part of it undue prominence, as in the case of the corset, which was first introduced when

clothes were not wanted for the concealment of the person, but to make more prominent the curves and undulations of the figure. The ruff grew out of a scrofulous complaint on a royal neck; the hoop-skirt, to conceal the *enceinte* condition of a French queen.

The Corset in History.—Dr. Bouvier divided into five epochs the transformations undergone by the corset, or by that part of the clothing which took its place from earliest antiquity to 1853.

The first epoch is that of antiquity; in this, as we have seen, the band or girdle, which was worn by the Greek and Roman ladies, was the forerunner of the corset.

The second epoch comprises a great part of the Middle Ages. This was a period of transition which partook of the styles which preceded and followed it. At first there was an abandonment of the narrow Roman band, and later the introduction of the corsage fitting tightly about the body.

The third epoch embraces the end of the Middle Ages and the first part of the Renaissance, which was marked by the general adoption of robes with a very tightly laced corsage.

The fourth epoch is that of the whaleboned corset, which extended from the middle of the sixteenth century to the end of the eighteenth.

The fifth epoch is that of the modern corset.

The busk, known since the fourth century, was introduced into France in the sixteenth century; men also wore busks or stomachers. The busk relates closely to the history of corsets. The middle of the sixteenth century is the epoch of transition from the corsage to the whale-boned waist, which constituted a sensible approach to the modern corset.

We find that the reign of Queen Elizabeth was marked by the first use of the whalebone stays. These were much affected by her successor James, who insisted that all his courtiers, male as well as female, should cultivate the appearance of the wasp.

The corset of George II, represented in Hogarth's pictures, is said to have been one of the most harrowing forms of screw torture. We are told that the doughty warriors of Gustavus Adolphus wore stays almost to a man.

To Catherine de Medici is generally attributed the introduction of the closely whaleboned waist into France, and the corset which she invented resembled in more than looks that instrument of torture—"The Machine Virgin of the Inquisition." This corset was made of steel, and was as inflexible as a suit of armor, and, like a warrior's breast-plate, consisted of two pieces. It opened longitudinally by hinges, secured by a hasp and pin, made like an ordinary box fastening. In the front and back a rod or bar of steel projected in a curved direction downward, and on their bars depended the adjustment of the long-peaked body of the dresses and the set of the skirt behind. During the forty years in which she ruled at court a thirteen-inch waist measure became the accepted standard.

Madame de Sévigné, born thirty years after the death of Catherine de Medici, formulated the axiom which has since been a law to the French modiste, "Les hommes ont la permission d'être laid; les femmes ne l'ont pas; aussi n'en est-il aucune qui consente à l'être."

The idea of the waist was unfortunately that which concerned the execution. Instead of being adapted to the body or figure, in accordance with its form, to bend with its movements, as the supple corsage which preceded it had done, this new garment became an inflexible mold, which distorted the natural contours and imposed upon them a conventional mold, and prevented the least variation of size or situation of the contained organs, as well as their continued integrity and the proper performance of their functions.

The use of the whaleboned corset prevailed even among infants scarcely out of their swaddling clothes. This was the natural consequence of the pretended necessity to mold the human form in order to obtain beautiful pro-

portions, to reform nature, and prevent her mistakes, and one could never take too much care to obtain such laudable ends. Mothers would have been considered culpably indifferent of their children who had neglected these first indispensable cares for the regulation of the formation of their bodies.

The Crusade Against the Corset.—From the time of Galen, 130 A.D., to the present day, in spite of the anathemas hurled against it by the state and medical profession, denouncing this great injury which woman does herself, has the corset still prevailed.

In the thirteenth century, Henry III, having permitted its use for some time, proclaimed a very severe edict against the wearing of corsets, which was considered so pernicious to the health of women, but of no avail.

In the fourteenth century an edict was issued by the Emperor Joseph of Austria, forbidding the use of corsets in all nunneries and places where girls were educated, and calling upon the Church to aid him, threatening excommunication to those evil-disposed damsels who should persist in operating upon their waists. The College of Physicians of that day took up the subject with activity and zeal, and dissertations upon the evils of tight lacing were scattered broadcast.

Professor Virchow, that eminent pathologist, wrote, "What is the use of introducing the principles and appliances of hygiene into the huts of the poor and ignorant, when the scions of wealth and pretended intelligence, especially of the gentler sex, show their contempt of hygiene by their dress and general wearing apparel. In days gone by I have battled against that diabolical invention called the corset, but this crusade has been given up by me as absolutely futile."

The modern hygienist has taken the stand that, since the corset cannot be suppressed, it *must* be reformed. About 1880, for the first time, some attention began to be given to the hygienic consideration of the style of the corset.

The Influence of the Corset on the Female Body.—As a result of the four hundred years in which the corset has molded the plastic form of woman, she has become physically so degenerated that it is necessary to have recourse to the artifices of the modiste in order to have even the appearance of a good figure, and the support afforded by the corset to maintain the erect position.

The modern corsets, made of one piece, can be classified in three categories, according to the region of the body

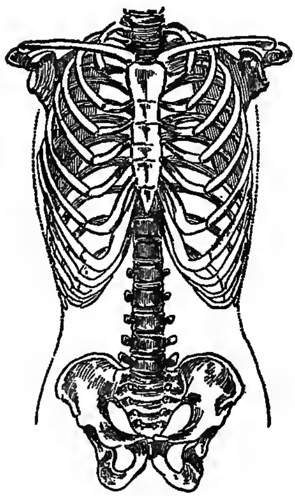


Fig. 13.—Normal chest.

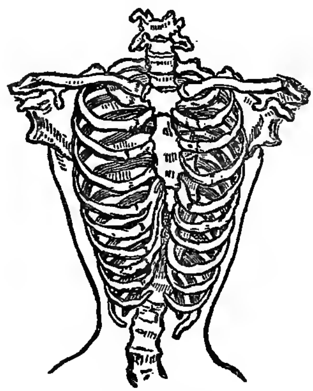


Fig. 14.—Effects of tight lacing on bony thorax.

on which they exert the greatest pressure. First, the "curved front" corset, enveloping the thorax and abdomen, but making the strongest compression at the base of the thorax; second, the "straight front" corset, enveloping the thorax and abdomen, but making the strongest pressure upon the abdomen; and third, the "abdominal corset," only embracing the abdomen, and supporting neither the breasts nor the base of the thorax.

In studying the effects of the corset on the body they will be considered in this order.

The Curved Front Corset.—The corset is applied to the trunk of the body, consisting of the thoracic cavity, a distensible cage containing and filled by the heart and lungs; second, the abdominal cavity, whose walls are almost wholly composed of muscles, and containing the liver and the entire digestive apparatus; and third, the pelvic cavity, whose walls are partly bony and partly muscular.

When the anterior wall of the body is forced to take the shape of this curved corset, it is pressed back toward the vertebral column, and even when the corset is not laced tightly, there is always more or less constriction of the base of the thorax, so that a serious deformity of the lower part of the thorax and abdomen is produced; instead of the normal outward curve of the anterior surface of the body, with its most prominent part in the region of the umbilicus, there results a broken line at the waist, and an obtuse angle is formed here, pointing outward. This causes a marked incurvation of the lower part of the chest and its approach toward the spinal column, with a corresponding flatness of the chest and lessening of the respiratory capacity of the lungs, and the action of the heart is seriously interfered with.

The chest or thorax is forced into the shape of a cone, the lower opening is narrowed, and its walls are brought too near together. The lower ribs become too short, and, if the corset is worn early in life, the upper ribs become too long; and the thorax as a whole is too long.

The greatest constriction produced by the corset occurs in the plane extending from the ninth to the twelfth ribs, which corresponds to the position of the diaphragm, stomach, and liver.

Just how seriously the curved corsets interfered with the expansion of the lungs was shown in a paper published by Dr. Sargent in 1889. He found that the average lung capacity when corsets were worn was one hundred

and thirty-four cubic inches; when corsets were removed, the lungs showed a capacity of one hundred and sixty-seven cubic inches—a gain of thirty-three cubic inches; that is, corsets crippled the lungs to the extent of one-fifth of their entire capacity.

Nature endeavors to make up this loss by the increased rapidity of the heart's action and more frequent respirations, but this is at the expense of greater wear and friction of the machinery. Palpitation and shortness of breath follow, and the woman is obliged to give up all active exercise.

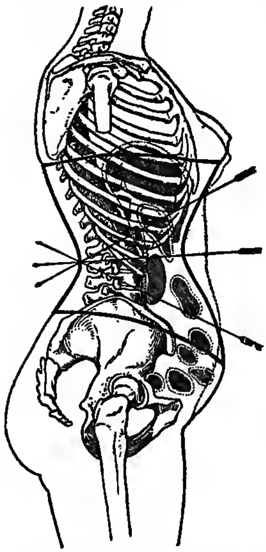


Fig. 15.—Diagram showing the action of the curved front corset (O'Followell).

Through this failure of the suction power of the heart there result disproportionately larger lower limbs and an accumulation of adipose tissue below the waist. This condition is much more common in women than in men, and is due to the lack of power of the heart to draw the blood back from the lower limbs against the force of gravity. Hence, the blood tends to linger in the lower extremities and the oxidation of the tissues is interfered with.

The Relation of Corsets to Abdominal and Pelvic Disorders.—By the constriction of the lower part of the thorax, as we have seen, the action of the diaphragm is very greatly impaired; this not only seriously interferes with its respiratory function, but with digestion as well, since, by the active contraction of the diaphragm in inspiration, it presses down the liver and other abdominal contents, and produces a powerful massage of those organs,

which aids in the digestion of food and in the unloading of the bowels, and, at the same time, the pelvic circulation is interfered with and pelvic congestion is favored.

The direct pressure of the corset upon the side walls of the chest forces the ribs in upon the abdominal contents; the liver suffers most from this, and not only does the liver sometimes actually show furrows upon its surface from the pressure of the ribs, but, in the postmortem room

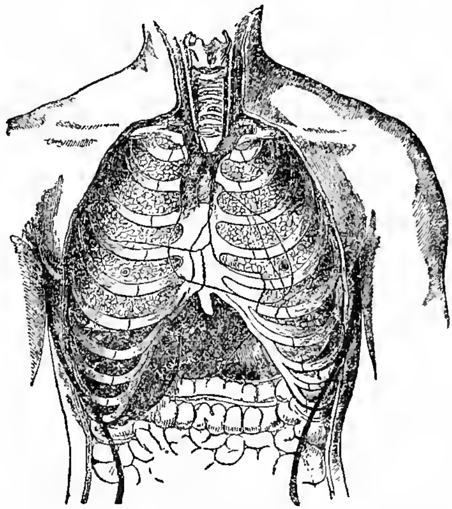


Fig. 16.—Relation of bony thorax to lungs, heart, liver, and stomach, with artificial outline produced by corsets (after Gray).

of the great Vienna Hospital deep grooves upon the liver were repeatedly found with great distorsions of the body caused by the corsets, and, in a few instances, the left lobe of the liver was found to be nearly separated from the right.

By the constriction of the waist, the liver and all the abdominal contents are pushed downward below their normal position, and their functions are greatly interfered with. The effects of this pressure upon the stomach

are most disastrous, and cause a host of digestive and nervous troubles. There is very frequently a prolapsus of the kidneys; the right one is more frequently prolapsed than the left, owing to the relation of the right kidney to the liver.

In a study of 50 cases Dr. Gallant found that in 90 per cent. the stomach was pushed down below its normal level, and in 80 per cent. there was prolapsus of the right kidney.

The constriction of the waist crowds the small intestines, with the accompanying mesentery and colon, into the pelvis; if the rectum is loaded with feces and the bladder empty, there follows an anterior displacement of the uterus; if, on the other hand, the rectum is empty and the bladder distended, there is a backward displacement of the uterus. In very many of these cases the compression and constriction are great enough to interfere with and retard the peristaltic action of the intestines, and constipation is produced.

Gynecologists are unanimous in the opinion that tight lacing is a most serious impediment to the development of the pelvic organs, and is a prominent factor in causing disease of these organs. Tight lacing displaces the uterus downward from two to three inches, and, at the same time, the pelvic floor is bulged downward from two and one-half to three inches and the circulation rendered sluggish.

When there is no interference with the respiratory movements the uterus rises and falls with every breath, and the movements of the uterus promote the circulation of the blood in the pelvis.

A high corset compresses the breasts, and so interferes with their development. The low corsets of the present day support rather than compress the breasts.

The Effects of Corsets on the Muscles.—In the back the corset forms an extended plane from top to bottom, destined to support the posterior part of the thorax and to diminish as much as possible the size and projection of the shoulder-blades. This compression of the

muscles of the back leads to their atrophy, and, as it is their function to hold the spinal column erect and to approximate the shoulder-blades to the thorax, when they become atrophied the bony parts become much more salient. Further, the corset, in weakening the muscles of the dorsal region, interferes with the normal forward projection of the chest, and so leads to its flatness.

The corset atrophies the articulations of the vertebral column, produces a round back, an inequality in the height of the hips and shoulders, with the resulting familiar awkward, waddling gait.

When the healthy skeleton offers to the muscles of the body a solid base of support, the action of the muscles of the back are not interfered with, there is nothing to prevent their contraction, and the body is held erect. With a perfect muscular development, the shoulders are effaced, the back is admirably straight, and the carriage is erect and graceful.

The strong compression of the muscles of the abdomen not only destroys the normal contour of the body, but, by the atrophy of the abdominal muscles, a partial paralysis is caused, and so the support which should be afforded the viscera by these muscles is weakened, and a prolapsus of the abdominal contents follows.

It will be seen that the two bony cavities of the body are connected in the back by means of the vertebral column and are not immovably fixed in relation to each other, but by reason of the flexibility of the spinal column, they can be approximated or the distance extended. The suppleness which results from this mobility corresponds to the physiologic needs, and constitutes one of the most essential conditions for gracefulness of carriage.

The movements of extension of the chest are rendered possible by the action of the muscles of the back, which hold the trunk erect and extend the vertebral column.

When the corset is applied, the compression and constriction fix all those portions of the muscles at and below the waist; the action of the muscles between the chest

and pelvis is diminished at least one-half, so that these muscles become atrophied from disuse, and when the corseted woman wishes to straighten up the movement must be executed by the entire trunk.

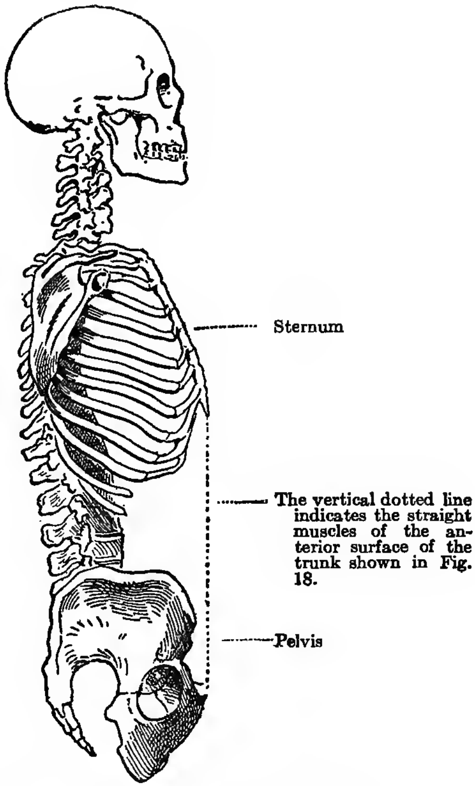


Fig. 17.—Skeleton of head and trunk (O'Followell).

Without the corset, the pelvis remains fixed and furnishes the normal base of support for the thorax, which gains the erect position through the action of the muscles of the back acting on the vertebral column.

Whereas, with the corset on, the pelvis is immobilized, and it follows the movements of the thorax. The movement of extension of the thorax, instead of taking place in the region between the false ribs and pelvis, take place at the hip-joints—the vertebral column remains rigid, it takes no part in these movements.

Then, as a result of the incurvation of the anterior surface of the trunk, there is an interference with the

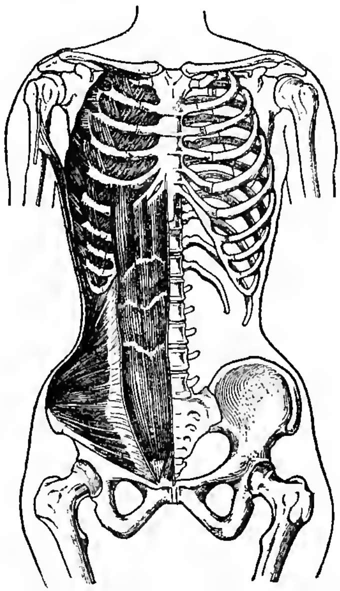


Fig. 18.—Muscles of the anterior surface of the trunk (O'Followell).

movements of extension of the spine and its immobilization, which causes the propulsion forward en masse of the abdominal contents. The anterior portion of the chest is shortened, and an exaggeration of the sacro-lumbar angle is produced.

On the sides of the body lateral flexion of the trunk is possible, through the contraction of the muscles between

the chest and pelvis, but with corsets on this is impossible. The two cavities are fixed by the rigid armature which composes the corset. This not only prevents the lateral flexions of the body, but also causes an unnatural depression above the crests of the ilium. The waist is constricted to such an extent that the woman can only fasten her corsets in front by having them widely separated in the back.

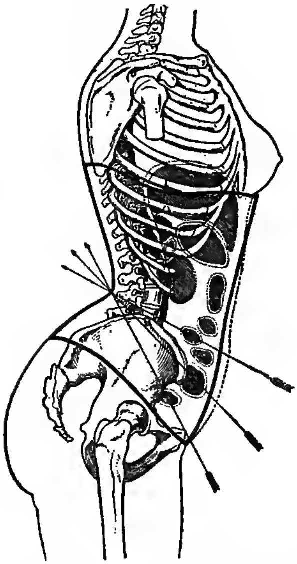


Fig. 19.—Diagram showing the action of the straight front corset (O'Followell).

All these conditions cause a complete immobilization of the thorax on the pelvis, so that the movements of the upper part of the body are characteristic in corseted women, and she moves all in one piece.

The Straight Front Corset.—This corset, when worn loose, is a great improvement on the curved-front corset. When properly fitted, all the compression comes at the hips and across the lower part of the abdomen, which is lifted up, and the waist-line is increased in size. This corset has for its base of support the bony pelvis, and there should be sufficient space to easily introduce the hand between the lower part of the thorax and the corset. In this case there is great freedom of movement of the entire chest cavity, so that respiration is not nearly so much interfered with as in the curved-front corset, and if the corset is properly fitted, the lower part of the abdomen is raised together with the contained viscera, and, indeed, this style corset is prescribed in cases of prolapsus of the kidneys.

By having the base of support from the bony pelvis, the chest is left free, and a good chest expansion and its throwing forward is favored, and at the same time an erect carriage is secured.

The waist-line runs below the short ribs, which lengthens the waist, producing graceful lines without compression.

But not all straight front corsets fill these conditions. Unless sufficiently long and well fitted about the hips, they may fail to raise and support the abdomen, and when too tightly worn may press too strongly upon the abdomen in the pretext of obliterating it, with the result that it is placed in a vice from before back. Pressed down, the intestines find a means of escape at the lower border of the corset.

The front of the corset is frequently carried too high up, and does not leave the epigastric region sufficiently free. The corset must absolutely not be thoracic, and must definitely renounce the support of the breasts, which should be accomplished when necessary by an extra bust supporter. The long straight corset immobilizes the trunk in the same manner as the curved front corset.

The Abdominal Corset.—In 1902 Madame Gaches-Sarraute proposed to abandon the thoracic corset and to introduce instead the abdominal corset. This corset embraces the pelvis without compressing it, and takes as the foundation of its support the bony girdle; the plan of the line of support is oblique, and inclined forward in such a way that there can be no compression.

In this way the pressure, instead of coming from above and annuling the contractions of the abdominal muscles, comes below and reinforces their action; the stomach resumes its normal position, and is supported in the plane of its greater curvature, facilitating its functions, so that digestion will be performed under the most favorable conditions.

The abdominal corset should not exceed the height of the false pelvis, should have as the base of support the bony

girdle of the pelvis, and should be rectilinear in front and very slightly curved in the back and below. The hips should be simply surrounded and their projection preserved. A curve which follows the normal sinuosity of this plane joins the piece from the hips with that of the abdomen.

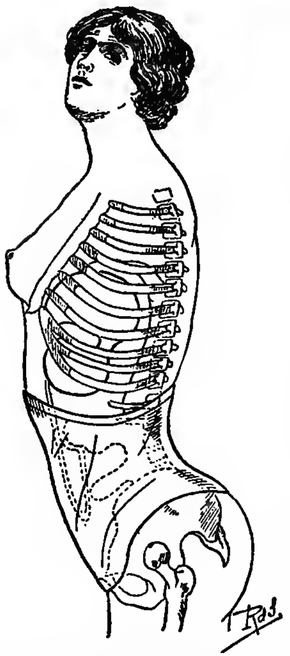


Fig. 20.—The abdominal corset (O'Followell).

The part corresponding to the back must be sufficiently wide and free, so that the posterior borders of the corset will be parallel when it is put on, and the plane preserved for the back in the pieces which form the corset. This garment will be adjusted without strain in the back, and it will embrace the form of the body so exactly that it can be put on without being unlaced.

The frame of the corset must be reduced to a minimum—a rigid busk in front and some whalebones in the back; the hips remain free, and a slight, separate brace supports the breasts.

The Wearing of Corsets by Young Girls.—The greatest dangers come from putting corsets on young girls who are still growing and are very imperfectly developed, and later by an undue constriction of the lower part of the thorax and the waist, so that the development of the entire body and its organs is seriously interfered with and all beauty of form is prevented.

The muscles of the back, like those of the abdomen, are prevented from their full development, and, later,

in their action, by the use of the corset. The earlier the corset is put on, the more pernicious will be the effects, because during the period of growth the bony framework is more pliable and delicate, so that a relative slight compression is sufficient to make an indelible impression upon the form. Before the complete development of the hips and the entire bony framework an enormous amount of harm is done by the wearing of corsets.

In early youth the heart lies higher than in the adult. By narrowing the intercostal spaces, the heart is retained, as it were, in its youthful position; in the adult female the heart is found to lie higher than in the male, and the contraction of the space in which the heart has to play is one of the causes of woman's fainting, and it is also a cause of organic disease of the heart.

At puberty, when the girl is rapidly increasing in stature, and her menses begin to be a drain on the system, relentless custom adds the compression of the corset and long skirts, suspended from tightly drawn bands around the waist.

The spinal column at this age lengthens rapidly, and it should carry upward all the viscera attached to it; but, owing to the weight of the clothing and the compression at the waist, this normal process cannot take place; instead, there is stretching of the ligaments, and the viscera are prevented from rising and hang at a level much below the normal.

A girl of this class is apt to be slender, with undersized hips, and has a characteristic configuration of the anterior surface of the body, a hollowing out of the region over the stomach, and a very great protrusion of the abdomen.

The uterus remains undeveloped and in an infantile state until near the approach of puberty, when it develops rapidly, and continues to increase in size until the normal size is attained—about twenty years of age. By the putting on of corsets the free mobility of the uterus and its appendages and their normal development are interfered with.

This period of growth and development is one of the greatest importance for the future health of the woman, both physically and mentally, and the most intelligent care should be given the girl at this impressionable age. By putting corsets on their daughters at this time, mothers are doing them a very great wrong, which can never be entirely atoned for. The corset prevents growth, development, and the participation in those exercises which make for physical vigor and good health. To the well-developed girl corsets are as much of a superfluity as crutches would be, and nothing but the prevailing style of dress causes girls to put them on.

It has been suggested that the wearing of any kind of corsets before thirty years of age should be a penal offense; and in case of a minor, the parents should be fined from one hundred to one thousand dollars.

As regards the wearing of corsets after the age of thirty, opinion is divided into three clases—first, those who utterly condemn their use; second, those who approve of it; and third, those who tolerate the wearing of corsets, but only under the condition that they shall cause absolutely no constriction.

What Style of Corset is the Least Injurious?—From the nature of the structure of the chest and abdomen and the functions of respiration, circulation, digestion, and the pelvic organs, the wearing of any style of corset must be more or less detrimental to the health and vigor of woman, and a perfectly developed woman, in perfect health, does not need a corset if she lives under normal conditions of dress and life; but in our present state of civilization, with the present style of dress, and with the very imperfect muscular development, women in and past the prime of life may wear hygienic corsets without any very great amount of injury.

The type of feminine beauty which approaches most nearly the ideal is that of harmony of proportions and modulations of lines. The waist proportions of the Venus de Milo is 47.7 per cent., while that of the Grecian man is

46.4 per cent. In proportion to her height the hips of the modern woman exceed the girth of those of a man by about four inches. and a woman of the same height as a man exceeds in hip girth by six inches. If the muscles which pass from the thorax to the pelvis were properly developed, the artistic proportions would be preserved, and the waist of the woman would be proportionately larger than those of a man.

The ideal figures of the Greek women show a torso bounded by outward curves, softly melting into one another, until the broadest part is reached at the hips, thence again declining to the feet. The line from the armpit to the ankle is one of the chief lines of beauty in sculpture, while the anterior surface of the body should present, in the median line, a gentle curve from the upper end of the breast-bone to the brim of the pelvis, the convexity of the curve coming about the umbilicus. An inward curve of this line is a deformity artificially produced.

In order that the corset should become an inoffensive garment it must be well adapted to the figure, so that it shall not embarrass the action of the diaphragm or the vital organs or the movements of the body.

The injurious effects of wearing the curved front corset have been given, and this style of corset should be condemned without appeal, since its use is dangerous from every point of view.

The straight front corset is much less injurious than the curved front, but its use is detrimental to health, and prevents the free movements of the body, so that the abdominal corset remains the only one which is perfectly safe and at the same time esthetic.

The chief rôle of the corset must be to sustain the clothing and to prevent the constriction of the lines about the waist and to prevent the falling of the viscera.

This can only be accomplished by selecting the proper points of support for the corset; this is in the lumbar region of the spine and the crest of the bony pelvis, a region of several centimeters in height. Except for the vertebral

column, the viscera of the region immediately above this have no bony protection, and are subject to the greatest amount of constriction, the organs being piled up on top of each other, as it were, and thereby suffer very great displacement and impairment of function, while, on the other hand, the solidity of the bones of the pelvis permits of their use as a base of support for the corset, as well as for the clothing.

It is based on this idea that the hygienic abdominal corsets are built, and, further, this style of corset does not sacrifice the normal curve of the anterior surface of the body. That the abdominal corsets do not support the bust is no detriment, as the woman with very fully developed breasts can wear a bust supporter, entirely separate from the corset, and in those pathologic conditions of ptoses of the abdominal contents—and from an orthopedic point of view, the abdominal corset affords an excellent solution.

In order to prevent misfits, all corsets should be made to order; the measurements must be taken with the corsets removed. The corset must be shaped so as to fit exactly over the hips, with the lower parts of the busks very slightly curved, following the normal curve of the body. The upper part of the corset must be a little loose, in order to permit of the easy movements of the body. Behind, the line of the corset must correspond to the line of the body, in order not to interfere with the erection of the body. In front, the corset overlaps the pubic bones, and must be tight enough to give the abdominal contents some support.

Instead of the lacings forming two "V's," the lower V, with its apex at the waist-line, and the longer V superimposed on top of this, the ensemble of the lacings to be normal must form only one V, with the inferior point very elongated. The corset is too tightly laced if, when, with the strings untied at the waist, the upper parts of the corset separates.

The corset should be put on with the lacings wide open, be carefully adjusted in the proper position, and fastened

from below up. After the stocking supporters have been attached, the lower part of the corset is held down with one hand, while the other hand gently draws up the abdomen by means of drawing on the undervest, or slipping the hand within the corset; in this way the abdominal organs are lifted up. The corset is then laced from its lowest point to the waist-line, and from the top to the waist-line, in such a way that only one long "V" is formed. The laces are then firmly tied and slipped in under the corset.

Corsets that slip up are probably either too long waisted, too tight over the fulness of the hips, or there is not sufficient curve in the back and sides at the waist-line. High-backed corsets are apt to make the woman look round shouldered, while a low back gives smoother and more desirable lines.

The Shoe.—The style of the shoe is very closely related to the corset in the amount of harm it is capable of doing. Considering the fact that the feet form the base of support for the entire body, and that on their condition depends the woman's ability to take a sufficient amount of exercise and maintain her good health, surprisingly little attention is given to their care.[1]

The compression of the foot into a rigid body, not unlike the shoemaker's last, destroys the natural relation of the parts, prevents the growth, interferes with the circulation, compresses the nerves, weakens muscles and ligaments which should support the arch, and is the prolific source of corns, bunions, weak ankles, and "flat" foot.

But, in addition to the direct injuries to the feet, the excessive elevation of the heel displaces the center of gravity, and transfers the weight of the body for the most part from the heel to the line of union of the instep with the toes, a series of joints with shallow sockets not formed to bear the brunt of the body weight. In addition to which the equilibrium of the body can only be maintained by an increase of the natural curves of the bony framework, with the resulting increased curvature forward at the small of the back, is an increase in the

[1] See pages 337 and 339.

prominence of the buttocks and abdomen. This tilting forward of the pelvis interferes with the circulation of the pelvic organs, and their congestion and inflammation follow.

By walking around in her bedroom slippers any one can easily convince herself of the greater grip that the foot has on the floor when so clad, and of the greater ease and sureness in walking; this is chiefly due to the greater breadth of the sole, and the fact that the slipper has no heel. The greater firmness of men on their feet on slippery pavements is doubtless due to the difference in the cut of the shoe and the lower and broader heel.

The front part of the sole of the shoe must be so designed that the great toe will retain its normal position and rest on the inner border of the sole. In many shoes the great toe is forced out of its natural position toward the middle of the sole, and the tip, instead of pointing straight forward, is thrust toward the line of the sole. This not only lessens the thrust of the great toe as it leaves the ground in walking, but also leads to a malformation of the foot and ingrowing toe-nails.

The soles of the shoe should project a reasonable distance beyond the uppers, to give firmer support to the foot and to protect the soft parts in walking.

The front part of the upper leather must be broad enough for the free movement of all the toes in walking and in springing; when it does not give room enough for the toes to spread outward and forward in walking, they are bent on themselves. This makes the descent of hills and all active exercise and games very painful. Tight upper leather is also productive of chilblains and corns.

The shoe should be slightly longer than the foot when the entire weight of the body is placed upon it, and sufficiently broad for the foot to spread in walking; but, at the same time, the shoe must fit snugly about the heel and instep, or else the foot will slip forward in walking, and all the evil effects of too short a shoe will result.

The heel of the shoe must be broad and low. High

heels force the foot to keep perpetually and unnaturally on the stretch; if they are worn in early youth, they may bring about permanent deformity of the skeleton and of the foot. Moreover, the high heel interferes with the natural walk, in which the pressure of the foot on the ground passes from the heel to the toes. The high heel requires that the front of the foot should be set down first instead of the heel. The result is an awkward tripping gait and a short step, which is very fatiguing. This is one of the causes for woman's frequent dislike for exercise in the open air, such as walking, mountaineering, games, etc., and so the general health is affected.

Again, from the esthetic point of view, the size of the foot must be in proportion to that of the body. Artists declare that every foot that has worn a shoe is deformed, and so, when they wish to make a study of the foot, they go to the shores of Italy, where the peasant women have never worn shoes.

Paget's description of a perfect female foot is great breadth and fulness of instep, a well-marked great toe, a long second toe, projecting a little beyond the great toe, and a very small little toe.

Since the feet are the part of the body to come in direct contact with the greatest amount of cold, whether on the floor of the house or the pavement of the street, it is a matter of prime importance to the entire body that they should be warmly clad. While for house wear and in the summer time a French kid is a most comfortable shoe, for street wear and outdoor exercise in cold weather a heavier leather with thick soles is requisite as a protection against the cold and damp.

Rubbers should always be worn when the pavements are damp, even if it is not raining, and in snow-storms and very heavy rains cloth gaiters should be worn over the shoes, to keep the ankles dry, and later to protect them from the wet skirts.

The Stockings.—Great care must be taken to have the foot of the stockings sufficiently long and loose; this

is doubly the case with woolen stockings, which are apt to shrink so much in the wash. A too tight or too short a foot of the stocking interferes with the circulation and causes a cold foot, and when the stocking foot is too short, it produces the same deformities that too short a shoe does.

The trouble generally begins in childhood; mothers forget in buying stockings for their children that stockings shrink in the laundry and that children's feet grow. The result is that the stocking-foot is apt to be too short before it is worn out, and so the toes are bent or cramped together, and there is the starting-point for deformities of the feet as well as corns and bunions. As much harm may come from wearing too short a stocking-foot as too short a shoe.

Again, with the present mode of wearing the stocking supporters attached to the corset, or, indeed, one of the functions of the stocking-supporters may be said to be the holding down of the corsets, the supporters are shortened for this purpose, and as a result the entire foot of the stocking is pulled on, and an artificial shortening of the stocking-foot is produced; and this point must be borne in mind in purchasing stockings.

Woolen stockings should always be worn during the cold weather. Garters should never be worn around the leg, whether above or below the knees, since, in order to be sufficiently tight to hold the stockings up, they interfere with the circulation by the constriction of the leg, and so cause cold feet and greatly increase the trouble in case of varicose veins.

The Essential Qualities for Winter Underclothing.—These are that the clothing must be light, loose, warm, and equally distributed over the body. From the hygienic standpoint, the underclothing is the most important part of the dress.

We have seen that much of the energy of the body is spent in maintaining its normal temperature, and that the two main functions of the skin are the preservation of the

normal body temperature and the excretion of certain effete matters in the form of watery vapors.

In the temperate zones two qualities are required of underclothing—that it shall prevent the too rapid radiation of heat from the body and that it shall be absorbent. No material is warm *per se.* The warmth is necessarily derived from the body, so that what is required of the underclothing is that it shall confine the warmth in its meshes; atmospheric air being one of the poorest conductors of heat, the material should be so constructed as to imprison a considerable quantity of air in its meshes.

The second necessity is that the excrementitious matters should be rapidly absorbed, as they are being constantly poured out from the skin, so that the material must be absorbent in the highest degree, otherwise the fluids remain in contact with the skin to irritate it, and the atmospheric air confined between the undergarment and the skin rapidly becomes surcharged with gases and moisture, and so acts like a warm jacket around the skin. Heat radiation is interfered with and the skin becomes extremely sensitive to changes of temperature and to drafts.

Wool is a poor conductor of heat and a great absorber of water. Its powers of hygroscopic absorption is at least double in proportion to its weight, either cotton or linen, and this property is an important one. During perspiration the evaporation from the surface of the body is necessary to reduce the heat which is generated by exercise. When exercise is finished, evaporation still goes on, and, if unchecked, to such an extent as to chill the body. If dry woolen clothing is put on after exertion, the vapor from the surface of the body is condensed in the wool, and gives out again the large amount of heat which had become latent when the water was vaporized, and from this cause alone a woolen covering feels warm during sweating. In the case of tightly woven cotton and linen fabrics, the perspiration passes through them, and evaporates from the external surface without condensation; the loss of heat then continues.

In addition to this, the texture of wool is warmest from its poor conducting powers, and it is less easily penetrated by cold winds. The more readily material conducts heat, the cooler it feels. The property of the conduction of heat is in proportion to the closeness of the weave and the amount of air which it contains. For this reason all loosely woven fabrics feel warmer than closely woven ones, on the same principle that the more layers of clothing there are, the more layers of air will be retained between them.

The recent methods of weaving cotton and linen fabrics more loosely have materially reduced their general defects as underclothing in cold weather, and if cotton or linen is worn next the skin it must be so woven as to give both thickness and porosity to the fabric.

For the majority of people, during the wet and cold seasons woolen undergarments are the best. If cotton is worn, it must be loosely woven, so that it may entangle a large quantity of air within its meshes.

The underclothing should fit tolerably closely the outlines of the figure, without impeding the movements. Combination undersuits, which reach from the neck to the ankles, are the best; the weight should be adapted to the season of the year, and should be changed with the weather, regardless of the date of the calendar.

The great disadvantage of woolen undergarments is the way in which its soft fibers shrink in washing, and after a time become smaller, harder, and less absorbent. To avoid this, the greatest care must be exercised in the wash. Woolen fabrics are sometimes very irritating to the skin, in which case some of the loosely woven cotton or linen fabrics must be substituted. In the choice of woolen undergarments the touch is the best guide; there should be smoothness and great softness of texture.

In very cold weather the combination undersuit worn in the house should be reinforced by "equestrian tights" for outdoor wear. These come in black and can be drawn on over the shoes. They are a much greater protection against the cold and wind than a flannel skirt, and do not

possess the grave objection of winding about the legs in walking in the wind.

Lack of proper clothing of the lower part of the body is beyond question one of the chief causes of the great prevalence of pelvic inflammation and of Bright's disease in women.

But not only is there to be considered the danger of laying the seeds of disease from going out into the cold air while the body is too lightly clad, but also that, in order to maintain the normal temperature of the body in winter without the aid of warm clothing, requires a greater expenditure of nervous energy, which in turn is the equivalent of a large amount of life force. It is not only imprudent, but most injurious, to exhaust unnecessarily the powers, of the body, when mere mechanical appliances, like clothing, will obviate this continuous expenditure of vital energy.

Another way in which clothes save the wear and tear of the body is by diminishing the amount of heat the system must produce by the oxidation of the elements of food. When properly clad, there is less loss to the body of its heat, and consequently there is less food needed to supply this loss.

The Length of the Walking Skirt.—The present vogue of having the walking skirt five inches from the ground is an excellent one, as it not only considerably diminishes the weight of the skirt, but it interferes much less with the forward swing of the leg in walking, which otherwise has to be overcome by the muscular force of the leg. In walking, the length of the step should be proportionate to the length of the limb; the leg is carried forward by the unconscious swing at the hip.

The chief exertion in walking is caused by the raising of the foot and leg to the point at which it goes forward and downward. By any artificial shortening of the step, such as is caused, for instance, by long skirts, it requires much more muscular effort to walk the same distance. Besides which, there is the additional friction of the skirts,

which is increased by the slightest wind; this has been likened to the process of eternally walking through a field of long grass.

Another most important reason for not wearing long dresses on the street is that they stir up the dust and collect microbes, and thus contribute materially to the dissemination of the germs of disease and subject the wearer and her family to the risk of infection.

The question of clothing takes an important place in the hygiene of the lungs. All clothing may be approved which is sufficiently warm, and which allows of modifications according to the variations in the temperature, and does not hinder the movements of the body, and particularly those which are carried out by the respiratory muscles. In the first place, it is very important that the muscles about the shoulders should have perfect freedom of motion, in order that the expansion of the apices of the lungs should not be interfered with. Clothes which hang heavily on the shoulders, and especially those which grasp the neck tightly, are unsuitable. Special attention must be given to this point in the selection of winter clothing.

In going up long flights of stairs furs and heavy top coats should be taken off and carried over the arm; this will prevent much shortness of breath and gasping when one reaches the top of many flights.

The Winter Street Dress.—The street dress for winter should be warm enough to prevent a feeling of chilliness, and yet be light enough to prevent the wearer from becoming overheated while walking, or from feeling a sense of weight of the clothing, which is always a sign of being too warmly clad.

For outside coats impregnated woolen materials, waterproof, but at the same time porous, are the best, except in very heavy rains. A storm coat of some kind should complete the costume for rain or snow. The woman should never stay indoors on account of very cold or inclement weather, as being housed up and the lack of sufficient exercise make one very susceptible to the very sudden changes for which our climate is so notable.

CHAPTER IX

PHYSICAL TRAINING THE KEY TO HEALTH AND BEAUTY

The Ancient Greeks the Most Perfect Type of Beauty; the Cause of the Inferior Physique of American Women; the Physical Training of the Japanese Women; Improved Physique as the Result of Physical Training; Increasing Stature and Improved Physique of American Men; Report of the Royal Commission of Great Britain on Physical Training; Physical Training Among the Ancients; the Influence of Physical Training on the Health and Life of the Individual; the Effect of Exercise on Brain Development and Character; the Physiology and Pathology of Exercise; the Relative Proportions of a Perfect Female Form; Table of Standard Weights for Women; the Muscular System; the Benefits of Exercise; Passive Exercise; Massage; the Balance and Carriage of the Body; Common Defects in the Carriage of the Body; the Heart's Need of Exercise; the Gymnasium in the Campaign against Disease; Gymnastic versus Athletic Training; Exercise after Eating; Effect of Brain Fatigue on Body Fatigue, and vice versa; Marks for Physical Efficiency; Advantages Derived from Athletic Sports; Ethical Value of Sports for Women; Forms of Athletic Games Best Suited to Women.

PHYSICAL training is the key to all beauty of form and face as well as grace of motion. Beauty without health is inconceivable.

The Greeks were the devotees of the beautiful, and they were the most perfect embodiments of health and beauty the world has ever seen. Their splendid physique was due to their outdoor life, physical training, which began in childhood and youth, and was systematically carried on throughout life, their public baths, and their athletics, sports and national games. Beauty is the inevitable corollary of health.

And the Greek artists bequeathed to all future generations a legacy of untold value, using the men and women of the golden age of Greece as the prototypes for the most

beautiful statues which the world has ever seen, proving that through the perfect development of the muscular system alone can an ideal type of beauty be attained, and these statues also show that the women of that day were the physical compeers of the men.

The greatest attention to the physical development of her citizens was given in Sparta. Girls and young women were subjected to a similar, though less severe, training than men and boys. It included running, leaping, wrestling, and throwing the lance; these formed the favorite contests in the national games. Xenophen says: "The Spartans are the healthiest of all the Greeks, and among them are found the finest men and the handsomest women in Greece." The women of the Teutonic tribes frequently accompanied their husbands to war, and exhibited intances of the most daring bravery.

History, as well as these magnificent legacies in marble and on canvas, teaches us that no greater fallacy could be imagined than that "we are women, and therefore weak." On the contrary, " We are weak, because it never entered into our thoughts that we might be strong," and it has been repeatedly proved that physical deterioration can be overcome by exercise, and that the same means greatly increases the mental capacity.

In savage races women are the equal, if not the superior, of the men, and woman's smallness of stature, physical inferiority, and lessened powers of endurance must be attributed to the customs of civilized society carried on for hundreds of years.

The Cause of the Inferior Physique of American Women.—The majority of American girls and women of the present day have undeveloped muscles, a bad carriage, an impaired digestion, and are without skill in outdoor games, and unable to ride, row, or swim.

From the measurements of twelve hundred boys and girls, Professor Sargent ascertained that at the age of fifteen years boys are three-quarters of an inch taller than girls, but that the mean height in the two sexes is the same,

and that, taking the sum of the measurements of the head, chest, waist, legs, and arms, the mean total was equal in boys and girls. The sum of these measurements is regarded as indicative of the strength of the individual, but that, as a matter of fact, it was found that the girls did not compare favorably with the boys in point of strength. In capacity of lungs the girls were seventy cubic inches behind the boys, and that, in strength of the expiratory muscles, the weakest boy was stronger than the average girl. In strength of back, leg, chest, and arms, the showing of the girls was a little better, though considerably below what it should have been.

At twenty years of age the man was found to be five inches taller and twenty pounds heavier. The superiority of the male in strength was now much more apparent than at an earlier age. He now presented ninety cubic inches greater lung capacity and one hundred and forty-three pounds, greater strength of legs, while the muscular power of the arms and chest was more than double that of woman. The charts showed that women were physically inferior to men in almost every particular.

Dr. Sargent then goes on to say, "The principal characteristics of general form that distinguish civilized women from men are smaller muscles, sloping shoulders, broader hips, and shorter legs. The smaller muscles and the shorter legs may be said to be embryonic, while the superior breadth of the hips indicates a greater evolutionary advancement in this part of the body than has taken place in man. The constricted waist must be regarded as a deformity artificially produced. When the hips are large in the male or female, the waist will naturally be larger if the muscles which connect the trunk with the pelvis have nothing to constrict them. Since the hips of women are much wider than those of men, we should expect to find the waist proportionately larger in women than in men.

In close antithesis to these observations of Dr. Sargent's on the physical inferiority of American women to men, it is both interesting and instructive to note those of Dr.

Hancock in his work on "Physical Training for Women by Japanese Methods."

The Physical Training of the Japanese Women.—A Japanese woman is usually the peer of a man of her own race who is of the same age and height, especially when weights are about equal. This is due to the fact that the Japanese women exercise in much the same way that the men do, and devote fully as much time in the endeavor to gain strength.

In the Japanese system of bodily training, known as jiu-jitsu, it is considered advisable in the initial stages to have boy and girl contestants as nearly equal in age and height as possible. The girls enter the arena upon equal terms with the boys, and have proved their fitness to do so. Grown men and women practise together; other conditions being equal, the women show an equal amount of strength with the men.

The back of the average Anglo-Saxon woman is generally the weakest part of her body, while the normal Japanese woman satisfies the artist's ideals as well as the surgeon's. The average Japanese woman of to-day shows a figure as perfectly molded, and of as true proportions, as the women of ancient Greece were able to display.

First of all, the Japanese women are taught that life is impossible without a sufficient supply of fresh air. This internal cleansing with air is deemed of more importance than the bath which follows soon after. That the Japanese woman is a deep breather is shown by the firm muscles that stand out on the abdomen.

Consumption is a rare disease in Japan; even winter coughs are of rare occurrence. The Japanese look upon full, deep breathing as being the most vital function in life; food is not so important, although it is necessary. The best exercises are of little importance when the breathing which accompanies them is not properly done.

Improved Physique as the Result of Physical Training.—Dr. Mary Taylor Bissell, formerly the medical director of the New York Berkeley Ladies Athletic Club,

and one of the pioneers in the systematic physical training for women, gave as the result of her experience there, "The gain of twelve months' exercise in the gymnasium is, for the chest two inches, stature two inches, and an increase of 30 per cent. in the lung capacity; many of the strength tests were doubled, the spine became erect and the arm vigorous, and the girl gained for herself the consciousness of controlling her own body instead of having it control her."

Increasing Stature and Improved Physique of American Men.—Dr. Born's measurements of Yale athletes and students suggest the inference that American men are becoming physically greater than any other known race. Comparing averages in 1903 and 1908, it appears that Yale men are one inch and a half taller than their predecessors of five years ago; they are twenty-seven pounds heavier, broader chested, and have an increased lung capacity of seventy-two cubic inches.

The measurements of Harvard students, published last fall by Dr. Sargent, corroborate Dr. Born's deductions, that American college men have larger and more vigorous bodies than their fathers.

Dr. Sargent's association of vigorous brains with strong bodies is borne out by Professor W. T. Porter's examination of 30,000 school-children in St. Louis in 1893, and by subsequent observations made by other men.

It is the opinion of Dr. Crampton, director of physical training in the New York city schools, that this improved physique in American men, observed in the universities, is not in a small measure due to the fact that within the last five years athletics have been introduced into the public schools, so that there are now hundreds of teams of baseball, football, basket-ball, and track athletics, where there was only one before, so that already the colleges are reporting that the young men entering them are bigger than they were ten years ago.

Professor Phillips of Amherst thinks that the young women are certainly one inch taller and five pounds heavier

than they were ten years ago. This improved physique of Americans he attributes, like Dr. Crampton, to the fact that the American boy has now come in for his heritage of athletic sports, and he makes a strong plea for "adult play"—that every man and woman should have as good an opportunity as boys and girls to get out on an open space and play baseball, football, hockey, run, jump, and have a good time.

To show the importance which Great Britain places on physical training for boys and girls the following report of the Royal Commission of that country for 1903 is given under the caption "A National System of Physical Training."

Report of Royal Commission of Great Britain on Physical Training.—"(1) Physical training should be regarded as of equal importance with mental training.

"(2) During school life physical training is quite as important for girls as for boys.

"(3) Systematic physical training is necessary both for country and town children.

"The daily walk to school is exercise, but not exercise which develops the body as a whole, or counteracts the liability to stoop, to be round-shouldered, or to be slovenly in gait. Moreover, all children during school life must spend many hours with but little change of position, the effects of which can only be corrected by systematic physical exercise.

"It should aim at the healthy development of the body, as well as of the mind, by the regular development of all the muscles, the quickening of the intelligence and activity, and the formation of the habits of prompt obedience, precision, smartness, and discipline. The exercises should not be for mere display or entertainment, but each should have its particular purpose and value to develop all parts of the body.

"A certain amount of physical exercise once a day or oftener is preferable to even a greater amount, at longer or irregular intervals.

"Games are very useful and ought to be encouraged, but they cannot be played by all children, and usually the weaker ones go to the wall; that is, those most needing systematic development are excluded. Games affording opportunities for violent exercise are useful for the development of reserve strength, and form an admirable field for the cultivation of social and public spirit. We strongly favor their organization and development at all schools.

"For boys, in addition to the regular games, country runs, leaping and dancing the Highland Fling; for girls, skipping and hockey. For both, swimming is strongly advised."

Physical Training Among the Ancients.—Greek culture regarded the individual as valuable in and for himself, and sought to promote first of all his full and free development. The idea was symmetry and balance of parts, and, to attain complete and harmonious manhood, mind and body were trained together.

Games played an important part in the life of the Athenians, and their importance in the education of children was early recognized.

From the age of seven to sixteen it is probable that one-half of the day of the Athenian boy was spent in intellectual and the other half in physical education. The aim of the Athenian education was to produce men, independent but respectful, freedom loving but law abiding, healthy in mind and body, clear in thought, ready in action, and devoted to their families, their fatherland, and their gods.

Gymnastics included everything relating to the culture of the body.

The culmination of the Athenian education was dancing. As a supplement to gymnastic culture, it toned down the ardent exercise of the gymnasium and the over-energy of muscular development to the ease and grace which was the Athenian ideal.

The Romans.—The early Romans possessed some traits

in common with the Spartans. They were intensely practical and interested in those things whose usefulness was apparent. Education should fit a man for his work in the world.

A Roman structure, quite as characteristic as the Greek gymnasium, was the public bath or therma, found not only in Rome, but in every important provincial town in the days of the empire. Both made provision for exercise and contained a system of baths, but in the thermæ the baths occupied the greater part of the space, and the rooms and courts for exercise were smaller and fewer.

The Influence of Physical Training on the Health and Life of the Individual.—If we believe, with Spencer, that "Education is preparation for complete living," we must appreciate that good carriage, bodily control, physical judgment, will power, and courage are an important part of the equipment of every man and woman. These qualities are intimately associated with motor coördination, and they are best developed through physical training.

The power of self-preservation, by which the individual is enabled to handle his body easily under all conditions, and so escape physical injury and death, depends upon physical judgment of time and distance, and the ability to run, jump, vault, climb, and swim. These are all fundamental exercises.

The love of play and the ability to play a number of games contribute very largely to health and happiness. The play habit must be acquired in youth or it will never be developed.

The best qualities of mind and character can only be obtained through physical experience and physical struggle. With stalwart physique comes a vigorous type of womanhood, physical courage; with flabby muscles there is apt to result flabby thinking and flabby acting, superficiality, and inefficiency. Next to hunger the most dominant instinct is the play instinct.

The Effect of Exercise on Brain Development and Character.—The growing interest in preventive medicine, and the very great popularity of the opportunities afforded for athletic training, attest to the value which people are beginning to place upon health as an asset in their social, domestic, business, and professional lives.

But it is not generally or sufficiently understood just how great is the effect of physical training on the development of the brain or upon the mental activities. With a strong, vigorous action of the heart there is a feeling of courage and general exaltation, whereas with a weak heart and enfeebled circulation, fear and impaired mental activity predominate.

The manner in which the organic functions are performed not only determine the health of the body, but the temperament and character as well. There is a conservation of energy in the fashioning of the will—only part of the energy is expended in the outward effort, while the rest goes to lay the foundation of a future will, so that exercise builds up faculty and conduct character.

We cannot perform an act voluntarily unless we know what we are going to do, and we cannot know exactly what we are going to do until we have learned to do it. The very simplest movement brings about a change in the organic structure of the brain, and this change leads to more complex movements and further improvement in brain structure. Most skilled movements give more exercise to the central nervous system than to the muscles. Movements calling for a high degree of skill, correlation of the different senses, sense discrimination, fine coördinations, and a rapid and responsible exercise of judgment, all tend, through the action of the association fibers, to a high degree of brain development.

An essential feature of exercise is that a part of it at least shall afford amusement, diversion, and recreation to the overwearied and harassed brain. Hence, the necessity to introduce dancing, field sports, etc. By these means industrial efficiency, communal morality,

and social consciousness are promoted. Public amusements of a proper sort are a public necessity.

The great menace to the city is the limited opportunities for healthful play, and over one-third of the population of the United States live in towns. The physical side of the question is the largest, for it involves health, and consequently poise and self-control. It involves a legitimate occupation of surplus energy and its wise direction, and it also involves companionship.

The great object of physical training is then to secure the most perfect development of the body, with the corresponding development of the brain, so that the highest physical and mental efficiency of the individual may be attained.

The possession of a large reserve of muscle and nerve force, ready to be used in any emergency, gives confidence to the individual, increases the spirit of taking the initiative and undertaking grave responsibilities that come into the life of every woman, especially those who are engaged in the business or professional world, and the building up of this necessary reserve force is one of the inestimable advantages of a gymnastic and athletic training.

The Physiology and Pathology of Exercise.—Exercise is divided into active or voluntary and passive.

Passive exercise does not require any exertion of the will power. Massage increases the local nutrition of the parts, stimulates the nerves, and is restful, rather than exhausting, to the overwrought brain and wearied nerves.

Active exercise is further divided into exercise of effort and exercise of endurance. Under exercise of effort are classed all gymnastic feats. The primary object of a gymnastic training or education is to produce a symmetric development of the entire body, while, on the other hand, the training necessary to execute gymnastic feats produces an overdevelopment of one part of the body at the expense of the rest, as is seen in the arm of the blacksmith and the leg of the danseuse. All

exercises of effort, whether of strength, skill, or speed, demand and cultivate mental concentration, a rapid response of the muscle to the orders of the will, develop the power to accomplish complicated coördinations, and the knowledge of how these difficult movements may be performed with the least expenditure of nerve and muscle force. Exercising a muscle develops it up to its physiologic capacity, but if a muscle is habitually overworked, pathologic results occur, and instead of a quick, sharp contraction of the muscle, the contractions will be weak and uncertain, and, if carried too far, the muscle may eventually atrophy from overwork.

Exercises of endurance include walking, running, swimming, and rowing—the range of movement in these is much more limited than in exercises of effort. In these, each movement is well within the individual's powers, yet, by increasing the rapidity of the movements, or by their prolonged continuance, the total amount of muscular work accomplished may be very great. Normally, the contraction and relaxation of the muscles are comparatively slow, so that the poisonous waste matter producing fatigue is continually being removed from the tissues, and not allowed to accumulate; whereas, in exercises of effort, there is no time allowed for the scavengers to work, and fatigue of the most active muscles sets in rapidly.

Fatigue may appear in several forms, depending on the character of the exercise which produced it. When the exercise is sufficiently active, the amount of waste matter thrown into the circulation is greater than can be eliminated by the lungs; breathlessness and palpitation of the heart result; so soon as the equilibrium between waste production and elimination is established, the individual is said to have gotten his second wind. Or, again, a slow pace, too long kept up, will produce exhaustion, so that the products of tissue waste accumulate, the beat of the heart is fast, irregular and weak, the nervous system becomes stupefied, and the muscles fail to respond to the normal

physiologic stimulus. This is a form of fatigue not infrequently found among zealous housewives, in which the demands made upon the nervous system by continual and carking family cares, added to the very strenuous work of the household, exhausts both nervous and muscular systems.

Recovery from this form of fatigue takes a much longer time than the preceding. The individual is too tired to sleep, the night is troubled by disturbed dreams, there is a soreness and stiffness of the muscles and joints which remain for some days. There may be an actual rise in temperature, and the urine passed has a high specific gravity, with sometimes even albumin.

If, now, this overwork is continued over prolonged periods of time, without allowing sufficient time for the necessary recuperation, there follows a slow and profound exhaustion, which is much more difficult to overcome. In this condition the temperature becomes subnormal, the weight decreases, the skin and muscles become flabby, and the skin is pale, the eyes are dull and listless, and the individual is without ambition to rouse herself from her lethargy.

During a contraction each muscle-cell shortens and thickens, giving off some of its substance into the lymph-space which surrounds it, and absorbing food, consisting of carbohydrates and oxygen, from the surrounding plasma. Exercise improves nutrition by the rhythmic, automatic massage caused by the contraction and relaxation of the muscles on the vessels which they contain, while warmth favors the elimination of waste matter.

It has been proved by Hawk, of the University of Pennsylvania, in his experiments on the blood-count of an athlete in training, that various forms of active muscular exercise produce an average increase of 16.8 per cent. in the number of red corpuscles. When exercise is long-continued, the rate of increase lessens, and, further, the number may be decreased in greatly prolonged violent exercise. The explanation of this is that a large number

PLATE III

Senegalese woman. (From Stratz, after Dr. Rykens, in Shufeldt's "Studies of the Human Form.")

of cells lie inactive in various tissues of the body until they are brought into the circulation by muscular exercise.

Athletic training has been called "mainly heart training." Exercises of endurance do not require supreme efforts, but they do accelerate the action of the heart and lungs, and the aggregate of work done is very much greater than in exercises of strength, but the exercise must be sufficiently active to provide for the free circulation of lymph, which is carried on mainly through the massage of muscular contraction.

If a walk be so listless that there is not sufficient movement of the muscles to overcome the pernicious influence of gravity acting on the column of blood contained in the veins of the abdomen, thighs, and legs, the vessel-walls may become permanently overstretched and varicose. The exercise must be sufficiently active for the muscular contractions to empty the lymph-spaces and hasten the circulation. It usually raises the general bodily, as well as the local, temperature of the parts, and so facilitates the removal of the waste-products.

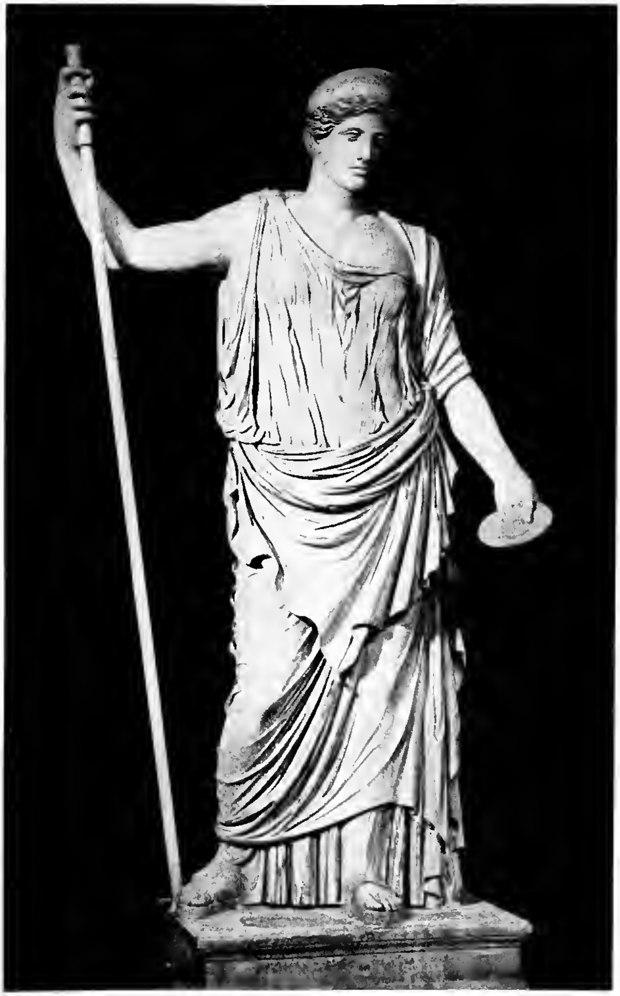
The acquirement of skill lies in the training of the nerve rather than the muscle. A simple movement requires only a nerve impulse to the acting muscle, while a complicated movement requires a wave of impulses to the accessory and antagonistic groups of muscles which control and steady the movement. It is easy to see how, in the first efforts to perform complicated movements, the contractions of the muscles will be jerky and inaccurate, many useless muscles will be employed, and the expenditure of nervous energy will be out of all proportion to the result, and these first attempts at new feats of skill rapidly exhaust the attention. This is well illustrated in the first efforts of a child learning to walk.

Exercises of strength and skill train that alertness of mind so essential in ordinary life. They shorten the period between thought and action, producing what is known as "presence of mind."

The Relative Proportions of a Perfect Female Form.—The relative proportions of a perfect female form, as deduced by modern sculptors from the Greek statues, are as follows: With a height of five feet five inches, the weight should be one hundred and thirty-eight pounds. The woman should, with the arms extended, measure from tip to tip of the middle finger, five feet five inches; that is, exactly her own height. The length of the hand should be one-tenth, the foot one-seventh, and the diameter of the chest one-fifth that of the height. The distance from the perineum to the ground should measure the same as from the perineum to the top of the head. The knee should be exactly midway between the perineum and the heel. The distance from the elbow to the little finger should be the same as the distance from the elbow to the middle of the chest. The measurement from the top of the head to the chin should be the same as the length of the foot, and there should be the same distance between the chin and the armpits. A woman of this height should measure twenty-nine inches around the waist, thirty-four inches around the bust, if taken under the arms, and forty-three inches if measured over them. The upper arm should measure thirteen inches and the wrist six inches. The calf of the leg should measure fourteen and one-half inches, the thigh twenty-five inches, and the ankle eight inches.

The table on page 297, compiled by Dr. Weisse, the Medical Statistician of the New York Life Insurance Company, "A Table of Standard Weights for Women," is based on the average weights of over 58,000 insured women, and is given to show the normal relation between the height and weight. A point of extreme interest in the table, and one that is not generally recognized, is the variation in weight, independent of the height, at different ages.

PLATE IV



Juno.

PLATE V

Venus de Capua.

Ages / Heights	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	Combined Ages
4′–11″	111	113	115	117	119	122	125	128	128	126	118
5′– 0″	113	114	117	119	122	125	128	130	131	129	120
5′– 1″	115	116	118	121	124	128	131	133	134	132	122
5′– 2″	117	118	120	123	127	132	134	137	137	136	125
5′– 3″	120	122	124	127	131	135	138	141	141	140	128
5′– 4″	123	125	127	130	134	138	142	145	145	144	131
5′– 5″	125	128	131	135	139	143	147	149	149	148	135
5′– 6″	128	132	135	139	143	146	151	153	153	152	139
5′– 7″	132	135	139	143	147	150	154	157	156	155	143
5′– 8″	136	140	143	147	151	155	158	161	161	160	147
5′– 9″	140	144	147	151	155	159	163	166	166	165	151
5′–10″	144	147	151	155	159	163	167	170	170	169	155
Combined Heights	123	126	129	132	136	139	142	145	144	142	133

Dr. Weisse found the average height of women to be five feet four inches, and the average weight one hundred and thirty-three pounds, and that the average male height was three inches greater than that of the female.

Women should range in weight from one and eight-tenths to two and two-thirds pounds to each inch in height. In order to determine your own factor in this respect divide your weight in pounds by your height in inches. Any weight above two and one-half pounds to the inch in stature may be considered as excessive, inasmuch as it adds nothing to one's mental or physical efficiency, and is frequently the forerunner of obesity, the remedy for which is to live on a selected diet and to burn up more through exercise.

In an ideal condition there is a sufficient quantity of fat to give a pleasing rotundity of outline. In women the tendency is for fat to accumulate, especially after forty years of age, about the waist, abdomen, and upper part of the thighs. In addition to the unsightliness which this gives to the figure, it is often the indication of the fatty degeneration of the muscles, and the heart is liable to become involved, and fatty degeneration of the heart is one of the frequent causes of death. The lack of use of the muscles in these regions of the body, which is caused by wearing corsets, is the reason for the accumulation of fat here. It can be reduced by the proper exercises and regulated diet.

The Muscular System.—The bony skeleton forms simply the framework of the body, and, while it determines the general outlines and height for the most part, the weight and general size of the body depend upon the muscular development and the amount of adipose tissue. The bones are not only padded about with muscles, but the muscles are inserted into the bony sheaths in such a way that a development of the muscles causes a development of the bones as well. Again, the stature is increased by the erect position of the spinal column, and this can only be attained by great strength of the muscles which

PLATE VI

Venus de Medici.

PLATE VII

Venus de Milo.

hold the spine erect. The inequalities of the muscles are filled out with adipose tissue, giving a pleasing contour to the face and figure.

There are some five hundred muscles in the human body; these muscles vary in size and form, according to

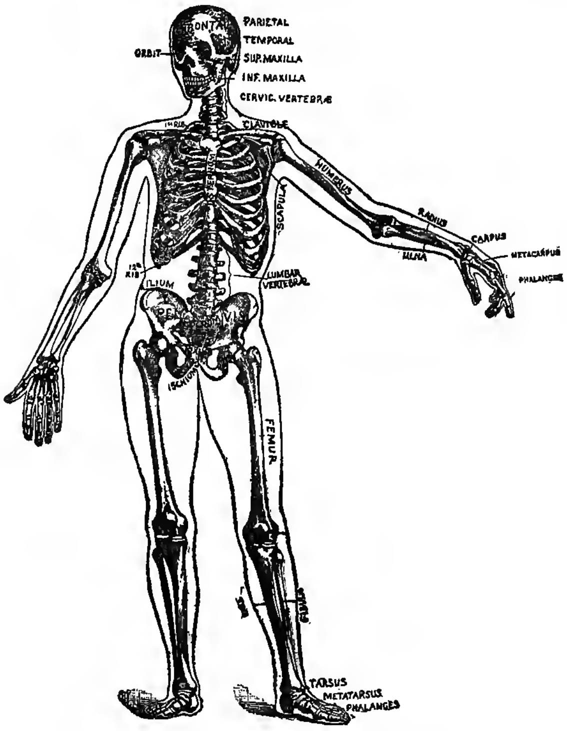


Fig. 21.—The skeleton (Lewis).

their situations in the body and the functions which they are called on to perform.

Nearly all the muscles in the body are arranged in two different or antagonistic sets, and are placed on the opposite sides of the part, so that in acting—that is, by

their contractions or shortening—they move the limb in opposite directions, and it is by the alternate contraction, or shortening and relaxation of the two sets of muscles, that the movements of the body are accomplished. The muscles which bend the joints are called flexors, while those that extend the joints are called extensors, so that in order to perform their work, which is that of contraction, the muscles must exert enough force to elongate the opposing muscles, overcome the tonicity of the antagonizing muscles, and lift the weight of that portion of the limb into which they are inserted. It is

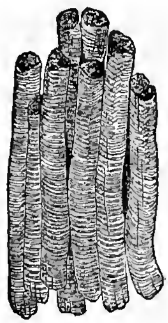


Fig. 22.—Muscular fibers, highly magnified.

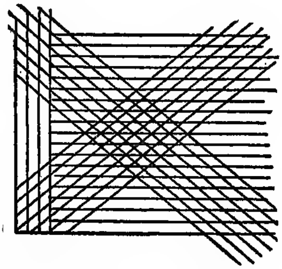


Fig. 23.—Different directions of fibers in the three layers of abdominal muscles.

by the action of the muscles that the body is held upright.

Action of the Muscles of the Abdomen.—The trunk is maintained from falling backward by the action of those huge muscles on its anterior surface. The space between the pelvis and the thorax is called the abdominal cavity. Its walls are almost wholly composed of muscles. There are several important facts to be noted about these muscles. First, that they extend from the brim of the pelvis, into which they are inserted, to the ribs and breast bone, to which the other ends of these muscles are attached;

that there are three layers of these muscles; and, lastly, that the fibers of the different layers run in different directions, so that they cross each other, as shown in the figure. The reënforcement of the layers, the arrangement of their fibers, and the manner in which they dove-

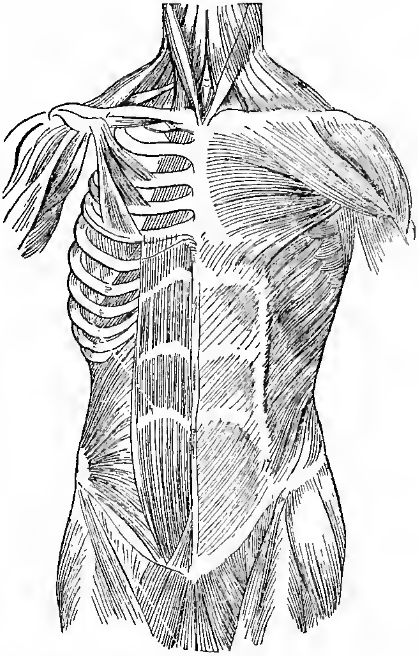


Fig. 24.—Muscles of the anterior surface of the trunk (left side, superficial; right side, deep).

tail into the adjacent groups of fibers give a structure of the greatest possible strength.

Action of the Muscles of the Back.—The trunk is kept from falling forward by the action of the muscles of the back. These are arranged in six layers. The cut shows the direction of the fibers. The first, or outside layer, consists of the trapezius and latissimus dorsi, or, in other

words, the broad muscle of the back. On the one side these muscles are attached to the spines of the vertebræ; the sharp ridge which is felt in the middle of the back, and the broad attachment to the pelvis afford a firm base of support. There are other muscles which run parallel

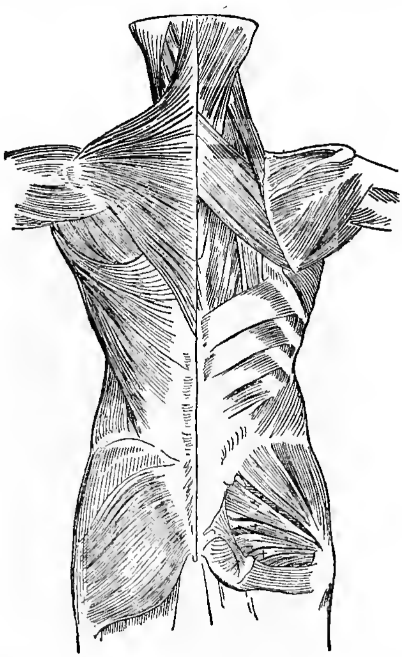


Fig. 25.—Muscles of the posterior surface of the trunk (left side, superficial; right side, deep).

with the spinal column, whose function it is to hold the spinal column erect.

Standing erect calls into action almost all the muscles of the lower extremities, trunk, and neck. So long as the line of gravity falls within the line of the feet, the muscular effort required is so slight that it is little more than the tonicity contained in all living muscle. The

greater the displacement of the line of gravity, the greater the muscular effort required to maintain the equilibrium of the body.

Muscular Energy.—The muscles of the body, even when at rest, are under a slight degree of tension. When stimulated, the muscle contracts—that is, it becomes shorter and thicker. A muscle can only remain in a state of contraction for a few seconds, because the force of the muscular fibers is more or less exhausted during contraction. The more rapid the contractions, the sooner does fatigue manifest itself.

Like the steam engine, the muscles of the body, in performing their work, produce heat and motion. The fuel which supplies this force is taken into the body in the shape of food; it is prepared for use in the intestinal tract, and from there carried by the blood, to be stored up in the muscles and various tissues as latent force. The muscles contain one-fourth of all the blood in the body.

Heat Production.—By watching a muscle when contracting, we see that there is not only a change of shape, but a dilatation of its blood-vessels, that is, more blood passes through a muscle when it is contracting than when it is at rest, and this increased flow continues for some little time after the contraction has ceased; there is also a rise of temperature. Nearly three-fourths of the heat developed in the body is produced in the muscles at the actual moment of muscular contraction. Hence, we learn that the whole body is heated by muscular exercise; the even temperature of the various parts is maintained through the circulation of the blood. This combustion, going on throughout the entire economy, is the source of all force or energy in the body. In every movement, every breath taken, in the change even of a muscle of expression or the conception of a passing fancy, combustion has occurred and potential force has been liberated.

Muscular Fatigue.—The fatigue produced by muscular

contraction may be due to the consumption of the readily available material present in the muscle, to the consumption of the supply of oxygen, or to the presence of the products of combustion, and, if Weichardt's theory is correct, to these must be added the presence of a definite "fatigue toxin."

During repose the internal changes of the tissue manufacture new explosive material out of the comparatively raw material already present in the fiber, and the directly hurtful products of the act of combustion are either carried off, or undergo changes by which they are converted into comparatively inert bodies. A stream of fresh blood may exert its restorative influence, not only by quickening both of these events, but also by carrying off the immediate waste-products, while, at the same time, it brings new raw material.

Every movement of the body depends as much upon the proper coördination of the muscles for its accuracy, grace, and force as upon the strength of their contraction, and while the fatigue, of which we are conscious in our own bodies after prolonged or unusual exertion, arises partly from the exhaustion of the motor nerves, it is chiefly from the exhaustion of the central nervous system concerned in the production of voluntary impulses. A man who feels absolutely exhausted may, under excitement, perform a very large amount of work with his already wearied muscles. The will rarely, if ever, calls forth the greatest amount of contraction of which the muscle is capable.

Passive Exercise: Massage.—Massage has been defined as the systematic manipulation of the surface of the body by the hands of the operator in movements of stroking, pinching, kneading, and striking. The passive movements consist of flexions, extensions, rotations, and other movements of joints and limbs by an operator or machine without the coöperation or resistance of the patient.

Massage takes the place of voluntary muscular movement, in promoting the flow of lymph and the flow of

venous blood toward the heart, if the proper direction, that of rubbing toward the heart, be followed; while, on the contrary, rubbing down a limb or from the heart actually retards the process which it is meant to facilitate. Gentle rubbing of any part of the body promotes growth, while vigorous rubbing removes superfluous fat.

Massage finds its widest field of usefulness in conditions of fatigue, where the elimination of waste matter must be assisted, and where the nutrition of a part is impaired or destroyed. Muscles can be improved in size, tone, and nutrition; ligaments can be stretched and lengthened, the general circulation accelerated, and overloaded veins made to disgorge their blood. The digestive tract can be stimulated, and overwrought nerves soothed and relieved of their hypersensibility.

The nourishment of the muscle-cell is improved by forcing out the products of fatigue and keeping it bathed in a constantly renewed stream of arterial blood. This alone is sufficient to prevent wasting of substance in conditions where active movements are impossible.

Massage relieves the nervous system by maintaining the nutrition of the muscles, without the expenditure of nerve force required to make them contract. It acts on the central nervous system through the nerves of sense, stimulating or soothing them, according to the nature and the amount of the manipulation.

Mosso and Maggiora, of Turin, have proved, by their experiments as to the effect of massage on the muscles, that muscles were capable of doing twice as much work after massage. It was also discovered that extending of the period of the massage did not produce any greater results in the capacity for work; the full effect was obtained in five minutes.

The action of massage in improving muscle tone, in postponing the onset of fatigue, and hastening recovery from it has long been recognized by athletic trainers. After a hard race or other contest, it is a matter of knowledge among trainers that a five minutes' treatment will

enable an athlete to repeat or continue a performance otherwise impossible.

Massage is the most economic form of exercise on the nervous system. Its potency is shown by the increase of the red-blood corpuscles and hemoglobin, and by the increased rate and force of the heart's beat without a corresponding change in the arterial tension. It accomplishes these results by decreasing the resistance in the peripheral vessels, by the removal of the products of oxidation, and by mechanically moving the blood-current forward in the lymph-spaces and venous channels. It is thus shown to stimulate the circulation, the respiration, nutrition, and excretion.

Mezger describes four principal manipulations: *First, stroking* or *effleurage,* in which the hand is passed lightly over the skin, with the pressure from the periphery to the center, following the course of the venous circulation, and the long direction of the muscles from their insertion to their origin. It may be performed by stroking with the palm of one or both hands, with the thumb or tips of the fingers. The two hands are used upon the large fleshy parts of the thighs and buttocks, the back, chest, and neck.

Second, Friction.—This is a deep circular movement, performed with the thumbs and tips of the fingers, or by one hand open or clenched. The products of fatigue collecting in deep muscular tissues are thus thrown into the circulation, the gentle manipulations of stroking carrying them into the superficial veins. The friction should proceed in the same direction as the stroking movements.

Third, pĕtrissage, also described as *pinching* and *grasping,* is performed by picking up the skin and subcutaneous tissues between the thumb and fingers, and manipulating it with an amount of force not sufficient to cause pain. In this procedure the skin moves with the hand of the operator, and the underlying structures are thus massaged by it under the pressure of the fingers. The thumb and fingers are used to reach the individual muscles

and small groups. The movements should proceed from the periphery toward the center. It is used to improve muscular nutrition in case of fatigue, in atrophy, in obesity, and other forms of muscular degeneration.

Fourth, Striking, Tapôtement, or Percussion.—Other names are clapping, beating, knocking, or hacking. It has a stimulating action on the skin, superficial nerves, and vessels. Hacking is performed by the ulnar border of the hand, and is used along the nerve-trunks.

Fifth, Shaking or Vibration.—Shaking involves movements of the whole body or region to be treated, while vibration is a lesser motion in which the body or region remains at rest, while the surface and the structures immediately beneath it are affected.

General massage is best given at an hour midway between meals, and never immediately after eating. The parts are at first lubricated with cocoa-butter or vaselin, to avoid the irritation which may follow the friction of the surface.

The first process of massage is the simple stroking to empty out the lymph-channels; the next process is directed to the deeper tissues. This is deep kneading, and skill is particularly required here. As the result of this, the muscles are toned up and the nerves are soothed, so that the total effect is that of sedation, and is followed by the removal of the fatigue toxins, so that if necessary it will be possible to undertake work after the massage that would have been impossible before.

The operator starts with the feet. After both surfaces of the foot have been well covered, the foot is firmly grasped and all the natural movements of the toes and ankles are gone through with. Next the region of the ankle, the leg, which is treated by circular friction by the fingers, by deep grasping of the areolar tissues, and, last, by deep pinching of the larger muscle masses. At brief intervals upward stroking is given from the ankle to the knee, to favor the venous flow of blood-currents. The same process is gone through with in the case of the hands and arms. Especial care is next given to the muscles of the loins, back,

and neck. The abdomen is then treated. Massage of this region concludes with deep kneading by the heel of the hand in the direction of the colon. The chest is manipulated upward, from the sternum along the line of the pectoral muscles. The face is not usually treated in general massage, but the sides of the neck are stroked from above downward, along the course of the internal jugular veins. Each part operated upon should be carefully covered as soon as finished.

There is a constant rise of temperature after the treatment, and there should be a rapid improvement in the tone and reaction of the whole muscular system.

The usual fault in giving massage is that too much is given at one time; the maximum effect on a part is obtained in five minutes. Another mistake is to employ too heavy a hand. A patient should never feel bruised or exhausted after the treatment; there should be simply a pleasant lassitude and feeling of drowsiness.

While massage is not essential for the health, it aids materially in maintaining good health, but, in order to be efficient, a skilful masseuse is necessary, as a considerable amount of manipulative skill is essential, which can only be acquired by proper training. Massage, especially when taken in connection with the Turkish bath, is most valuable to remove weariness of nerves and muscles, as well as slight aches and pains.

The Balance and Carriage of the Body.—The erect position of the body is maintained through the exertion or more or less muscular force. The base of the erect human body is the soles of the feet; the smaller the base, the more danger of a fall. The base is the smallest when one stands on the toes.

The way in which the spinal column is carried by the pelvis determines the way in which the whole body is carried. An erect and graceful carriage in standing and walking is not only desirable from an esthetic point of view, but it is most essential to good health. Without a proper development of the chest, it is impossible to secure

a normal development of the lungs and vigor of the heart.

It is upon the erectness, suppleness, and strength of the spinal column that most of the power and grace of the body depend. In the proper carriage the natural lines of the spinal column form a graceful and undulating line, and the body stands erect without any particular effort.

The curves of the spinal column are of great value in protecting the brain, as they weaken the force of any shock, which may be caused by striking the bones of the feet.

Common Defects in the Carriage of the Body.—Owing to the common faulty position of school children at their desks, the sedentary occupations of women, and their lack of physical training curvature of the spine is very common. A stooping carriage is the most common. The head is bent forward, the chest is sunken, the back is round, the shoulder-blades hang outward, the inner edges standing out like wings, and the abdomen is protuberant. The muscles are poorly developed and are weak and flabby.

This stooping carriage interferes with the freedom in breathing, and prevents the proper development of the upper part of the chest and lungs. Hence, it predisposes to lung diseases and tuberculosis, a weak heart, poor circulation, shortness of breath, inability to take proper exercise, and thinness of the blood (anemia).

Spinal Curvatures.—The spinal column is normally directly in the middle of the back; any deviation of this column to either side is abnormal, and the lungs become cramped in a small and non-distensible bony cage. This spinal curvature is most apt to take place in young girls or in adult women after a severe illness, when the muscles of the back have become particularly flabby, and, while still in this condition, improper attitudes are assumed at the desk or other sedentary occupations.

Preventive measures are of the utmost importance. First of all, comes the general strengthening of the body,

and of the muscles and bones in particular, by plenty of exercise in the open air.

The habitual attitude at the desk and work should always be carefully observed, and in all sedentary occupations the work should be frequently interrupted to take systematic breathing exercises before an open window.

Where spinal curvature has actually taken place, especial exercises must be taken under the supervision of a physician and instructor. Gymnastic exercises must be supplemented by outdoor games and sports.

The Heart's Need of Exercise.—The first essential for the maintenance of health, capacity for work, and power of resistance of disease is a normally developed and strong heart. First, there must be secured a vigorous circulation of the blood, and the two greatest helps to this are exercise and deep breathing. In the sedentary posture the heart works at a disadvantage.

For the young, exercise of the heart is the chief object of physical exercises; this object is best attained by exercises of speed, especially in the form of games which require rapid movement. In youth the recuperative powers of the heart and lungs are at the highest.

An adult cannot race and scamper about like a child who plays for hours together, and a disturbance of the heart's action brought about by strenuous exercise to the point of fatigue of the heart is not so quickly compensated. On the other hand, severe exercises of strength and endurance are not so apt to prove injurious after the completion of growth as they are in the growing youth. Up to the age of eighteen years no feats of strength or of endurance should be attempted. From eighteen to thirty years is the period of life when any kind of athletic exercise can be taken, not only without any injurious, but with beneficial, results. After the period of youth new conditions begin to make themselves felt, and more care must be exercised in the demands made upon the heart. In some persons obesity sets in before they have reached thirty and impedes the action of the heart. About the fortieth year the

walls of the arteries begin to lose their elasticity, they become more rigid, and chalk salts are deposited in them. Golf and lawn-tennis are now excellent.

And now it is most essential that exercise be kept up; the heart must still be trained and practised. The fibers of every muscle degenerates when their work is reduced to a minimum.

Proper health without proper breathing is a physical impossibility. It is necessary that those portions of the lungs which do take part in ordinary breathing, and which would atrophy from lack of use, should be fully developed and kept ready for suitable exercise. As soon as the lungs grow weary and the power of breathing is exhausted, the most powerful muscles of the body give way. The pleasure of vigorous walking, especially in mountainous places, is alone for her who can respond easily and readily to the enormously increased demands on the power of the respiration.

The direct result of exercise is an increased demand for oxygen by the tissues, and, to meet this demand, respiration is deepened and quickened, and the beat of the heart is more rapid and more forcible. But the phenomena of increased breathing power and increased heart action benefit other parts of the body. At the commencement of an exercise the contraction of the voluntary muscles called into action compresses the blood-vessels, and impels the venous blood actively toward the heart, which, thus stimulated, contracts vigorously, and propels the blood in increased quantity toward the lungs. Stimulated by the pressure of a large amount of venous blood, the inspiratory muscles contract and elevate the bony structure of the chest, the diaphragm pushes down the abdominal contents, and the air rushes in to fill the vacuum thus produced and to supply the oxygen necessary for the purification of the blood. Supplied with this life-giving element, the blood is returned to the heart, to be distributed again throughout the system, and to restore the loss incurred in the original muscular movements.

In this manner are not only the voluntary muscles enlarged and strengthened, but also the involuntary muscles, particularly the heart and the diaphragm. The increased activity of the circulation stimulates other organs to increased activity. The quantity of perspiration from the skin is more than doubled, the appetite is increased, digestion is more perfect, absorption is more rapid, the hepatic circulation is more active, and the abdominal circulation is carried on more vigorously.

But, on the other hand, actual harm may be done if any one who has been accustomed to lead a sedentary life, or who is not vigorous, suddenly engages in the more violent forms of exercise. In this extreme exertion the heart may be embarrassed by the respiratory action. At the end of deep inspiration the increased pressure of the lungs impedes the flow of blood from the right side of the heart, while the compression of the heart itself by the distended lungs tends to overfill the large veins, and to further endanger the right side of the heart.

During general muscular contraction the arterial pressure is increased at the outset of exertion, before the arteries have become relaxed, and this in turn may lead to the engorgement of the left side of the heart and the circulation through the lungs. To these conditions may be added still another; that is, the exhaustion of the respiratory muscles, partly because of the unusual amount of labor thrown upon them, and partly from the inadequate supply of properly oxygenated blood. If the disturbance of the pulmonocardiac equilibrium be severe and the condition unrelieved, general prostration ensues long before the muscles engaged in the work are exhausted. If, on the other hand, the equilibrium be restored, or when the heart and lungs have been trained to accomplish the restitution, the distress disappears, and the individual is said to have gotten his second wind.

The Gymnasium in the Campaign against Disease. —Women, generally speaking, do not take sufficient exercise. The trend of the present day is for girls of the richer

classes to lead an outdoor life, but the women of the middle and lower classes do not obtain enough variety of exercise or enough fresh air, and to the lack of proper outdoor exercise is due their anemic condition, pallor, flabby muscles, and generally ill-nourished appearance.

With the division of labor and the increase of wealth it has become possible for a large proportion of the community to live without much all-round mental or physical activity. As a consequence, there are faulty circulation and defective nutrition, the vital resistance of the body is lowered, and some of its various organs or tissues are ever ready to take on disease. The lowering of the tone of the body through dissipation, want of fresh air and sunshine, insufficient sleep, lack of proper occupation or recreation, also increases the susceptibility of the body to disease.

Senile decay is by no means only a matter of years, but the manner of life led. And very many people over forty years of age fall into a condition of senile decay, merely because they do not take a sufficient amount of active exercise. In consequence the joints stiffen, the muscles relax, and the arteries harden prematurely. The prime of life would be very greatly extended, and old age delayed, if women only continued their active interest in work and systematically kept up gymnastic exercises and outdoor sports.

For all classes of women provision must be made, and sufficient time afforded, to be devoted to some form of mental and physical recuperation and systematic physical training.

Gymnastic versus Athletic Training.—The actual experience of the past few decades has proved that the most effective way of developing the mental and physical powers and the constitutional vigor is through a judicious system of gymnastics, athletics, and carefully supervised plays, sports, and games.

To show which of the two contestants was the "better man" was the primary object of all contests, and this is the fundamental source of the love of games and athletics.

England has relied for her physical training upon a large variety of games and sports, instead of an elaborate system of gymnastics. The Englishwomen live an outdoor life, are great walkers, horseback riders, and go in for athletics and sports, and we find that the English women have a much more vigorous physique and healthy and ruddy appearance than their American sisters.

In Norway, Sweden, Denmark, Finland, France, Germany, and Italy more stress is laid on the gymnastic training, and in the Olympic contests, held in London in 1908, the twenty-five women from Denmark afforded a revelation to many of the Americans present.

Medical gymnastics had their origin in Sweden, and are practised largely in that country and on the Continent.

In gymnastic exercises the work done on each piece of apparatus must be tried repeatedly, in order to be learned, and then must be practised assiduously, in order to be well performed. This is what makes gymnastics so valuable as a means of physical training and development. The first essential is to learn to handle one's own weight, and to have the muscles of the body under complete control, and much of the interest and fascination found in practising heavy gymnastics come from this acquired power over one's own body, and the ability to make it do the feats and stunts which one desires it to do. This is one reason why children love to climb fences, trees, etc., and test their ability to handle and master themselves in new and untried situations.

But, in order that good and not actual harm may be done, gymnastics must be carried on under medical supervision. Bodily exercises should, as far as possible, occupy the mind at the same time. The fact that gymnastic training is being taken up in our high-schools and colleges for girls is a great gain, not only to the individual, but to the race as well.

The proper development of the body, the clear skin and eye, the upright and graceful carriage, the free swing of the body and limbs when they move, give happiness to

the possessor as well as to the onlookers. The esthetic advantages of health are very considerable.

Among the mental and moral advantages to be derived from the practice of exercises and games are a greater amount of self-control, persistence, regularity, promptness, and of general self-confidence. In the playing of games there is opportunity for originality as well as for observation. The unwritten code of honor, the need of accuracy—all these qualities are essential for a successful and happy issue in the great battle of life.

The ideal physical training requires that systematic gymnastic exercises should be supplemented by outdoor games and sports. Gymnastics are not sufficient for an all-round means of development, because the movements are too regular, too expected, and too deliberate, but they are invaluable for health and physical development, for the correction of physical deformities, as a foundation for many games and sports, and for supplementing the same. Many games are so one-sided that gymnastic exercises are essential to prevent the body from becoming unsymmetrically developed, and, further, gymnastic exercises must invariably be the foundation for all games; no games can do what they are really capable of doing without the firm foundation of the best gymnastic training.

Those exercises and games should be selected which are the most fundamental and the most healthy, which will cause the all-round development of the body, the muscles, heart, lungs, chest, a good condition of the blood, good circulation, breathing, digestion, and the getting rid of the waste-products.

Such exercises should teach obedience to law, self-control, regularity, promptitude, and readiness to meet fresh conditions or emergencies, persistence, pluck, and the ready coöperation of nerves and muscles.

The aim of gymnastic exercises should be to secure a symmetric development of all the muscles the body, to correct one-sidedness, spinal curvatures, and other

physical defects, and to strengthen all the muscles of the body. In the gymnasium especial attention must always be given to the development and strengthening of the muscles of the back and chest, as these are the ones that are apt to be the most poorly developed in women, since they are less called into play in walking, which is the only exercise that most women take, and on their good development and strength depend the upright carriage of the body, a good chest capacity, and, hence, good respiratory capacity, a vigorous heart, and good circulation.

Exercise after Eating.—Severe mental and vigorous bodily exercise immediately after a meal retards gastric digestion. The entrance of food into the stomach excites the free flow of gastric juice, which, like all the secreting processes, is dependent upon a flux of blood to the secreting glands. Other parts of the body, notably the brain, suffer from temporary anemia, and hence the great tendency to drowsiness after eating a hearty meal. At such a time severe mental work or vigorous bodily exercise must necessarily cause a corresponding withdrawal of blood from the alimentary canal to the brain, or, in the case of physical labor, to the extremities, in order to furnish the amount of blood necessary for the proper performance of the functions of these parts. The withdrawal of blood from the digestive organs has the effect of inhibiting gastric digestion, since there has been an interruption of a free flow of gastric juice.

We are safe then in believing that digestion is favored by rest of the stomach before eating, by gentle exercise of the mind and body after eating, and by an undisturbed mental condition.

An athletic training is productive of a more complete oxidation of the nitrogenous materials of the body, and, therefore, of a more economic utilization of these substances. In those cases in which there is lack of physical training, sudden muscular exertion is followed by a waste of nitrogenous matter.

The Effect of Brain Fatigue on Body Fatigue and

Vice Versa.—Brain fatigue makes the sense of touch less delicate. Similarly, muscle fatigue affects brain power; severe muscular exertion may bring a disinclination and incapacity for brain work. Hard exercise uses up nerve force, and also causes the circulation of waste-products in the blood, and so the action of the brain is hindered. On the other hand, many people who do a great deal of brain work know that an early morning walk, a pull on the river, is most refreshing and stimulating, and actually makes them more capable of doing good brain work; that is, if they are in fair training and do not take enough exercise to make them tired.

It is beyond question that a dull gymnastic drill, coming after hours of hard school work, may be a very heavy tax on the brain and nerves, and can hardly be a relaxation. Outdoor exercises, which require practically no brain work and a good deal of muscular exercise, would do good, such as walking, running, jumping, and various kinds of games; while, on the contrary, exercises of skill would be a serious tax.

The suggestion has been widely accepted, that brain work should occupy the morning hours, while technical education, such as singing, drawing, and physical training, should be given in the afternoon.

Marks for Physical Efficiency.—The tests suggested some fifteen years ago by Sir Francis Galton, the eminent English scientist, for assigning marks for physical qualifications were the following: First, breathing capacity; second, strength tests, both of them to be regarded with reference to the stature and the weight; third, quickness of response to a signal, made either to the eye or ear; fourth, keenness of eye-sight; fifth, keenness of hearing; sixth, color sense.

Dr. Sargent, realizing the usefulness of these tests in measuring physical efficiency, included them in the physical examinations of the Harvard students. The strength tests consist in the strength of each forearm, of the back of the legs, the dip, the pull up, and the lung capacity. The

combination of these seven tests is known as the intercollegiate strength test, and is the best means as yet devised for measuring the general muscular strength and the respiratory power.

The Advantages Derived from Athletic Sports.—Nothing can take the place of athletic sports to develop strong vigorous bodies in girls and young women. While formal gymnastics have both an educational and corrective value, and lay the foundation for athletic sports, they cannot take the place of outdoor sports to develop organic vigor, physical and moral courage, self-reliance, judgment, self-control, decision, and ethical training, a consideration for the rights of others, and a relaxation, particularly from mental work. Athletics are to youth what play is to children. Groos tells us that a function of play is to furnish an outlet for exuberance and animal spirits in the young.

The Ethical Value of Sports for Women.—First come the benefits to the individual and second the benefits to the community, and it is a self-evident fact that that which promotes the highest development of the individual raises the standard of the community.

The benefits accruing to the individual are physical, esthetic, and psychologic; and as the result of the development of the individual along these lines will result the fourth benefit, the social or the "community good."

Municipal governments are beginning to recognize the fact that the maintenance of public playgrounds not merely promote the good of the individual, but lessen the death-rate, the poverty rate, the criminal rate, and it has been found that the working capacity of the people depend in some way upon the recreation afforded them.

Sports for women are essential, not only to better fit the individual for her place in life, but as an offset to the deadly monotony of her work. The predominating note of sports should be joy, exhilaration, and the social features of games.

Women's sports, like women's clubs, are and should be

run along different lines from men's. The object of women's games are for their development and individual good, and should, therefore, never be played before indiscriminate audiences who pay an admission fee.

Women have the same necessity as children and men for a wholesome physical outlet for the exuberance of animal spirits and energy.

The esthetic value of games has been found to be expressed in the improvement of the personal habits and appearance, which indicates a higher standard of living.

And the psychologic value has been found to be a development of the mental and the moral qualities, and so the individual is the better enabled to direct her efforts wisely and so more successfully in life's activities.

All of this is not a matter of theory, but it is the universal testimony of the directors of the various athletic associations for women all over the country.

Among other developments along the physical line are endurance, skill, precision, and coördination. To be able to do physical things well has an ethical value in the individual's attitude toward life in all its phases.

The esthetic value lays stress upon the beauty and good form of games. It is essential in playing games that women should stand well, walk well, run well, throw well, and have a neat appearance. The manners and habits of the players on the field are also part of the esthetic training.

It has also been noted that for reasons largely beyond her control the primitive occupations of women have been taken out of her hands, and have forced her, in order to secure a maintenance for herself, or those depending on her for support, out of the home into the industries and occupations of the world, together with a fierce competition which this necessitates. In other words, success is based upon competition, and competition is the keynote of organized games. So that one of the values of games is to maintain fair, economic, and coöperative rules of competition. Other things being equal, the athletic man or

woman who has played according to the rules of the games is likely to be fairer than he who knows nothing of clean sport.

Some of the mental qualities developed are observation, attention, concentration, memory, imagination, initiative, reason, and will power. These qualities are most highly developed in the various ball games, from its simplest forms to team work, as baseball and basket-ball.

The moral qualities developed are self-control, unselfishness, a sense of honor, self-sacrifice, self-confidence, fairness, democracy of spirit, modesty, and decision. One of the qualities which characterizes a good player is that she will do the things which are assigned her. Promptness and obedience to order are the first laws in any game. Throughout the game self-confidence is taught. Each player has her own responsibilities, decisions must be quickly and accurately made, while overconfidence brings a sure defeat.

If competition underlies all games, it is equally true that unselfishness is the basis of all team work. The ability to work together requires at every point unselfish adjustment. One of the first things learned is to appreciate another's ability, and the individual egotism, so marked in the beginning of the work, is rapidly toned down.

Closely allied with unselfishness is the spirit of fair play, and closely linked with fairness is loyalty and a sense of honor, the lack of which makes girls the contempt of boys and women the despair of men. It has been averred that the social position of woman and her dependence upon her lord and master have lead her to become indirect and devious, hence her lack of perfect truthfulness and sense of honor, so that when put upon her honor she does not realize her responsibility.

Another great advantage that games possess for women is that many of them, from their weak physical condition, are abnormally sensitive and introspective; they live too much on the subjective side of life. While sports are primarily objective, they afford no opportunity for analysis

of feeling; the thought must be riveted on the thing to be done. Every girl's school and woman's club which provides opportunities for games and sports erect barriers against nervousness, morbidity, and too much introspection. These qualities which games develop are not masculine, but human; qualities needed for human fellowship.

The Forms of Athletic Games Best Suited to Women.—Dr. Sargent's conclusions as to the form of athletic games best suited to women, coming from a man of his wide observation and great experience, should be more generally known, and he says, without hesitation, that there is no athletic sport practised in which some women cannot enter, not only without fear of injury, but with great prospect of success. But the feminine type of build, whether found in men or women, is a handicap in many athletic contests. But these limitations do not apply to girls between ten and fourteen years of age. During this period girls, if properly trained, will often surpass boys of the same age in any kind of athletic performance. Moreover, if girls were given the same kind of physical training as boys receive all through their growing and developing period, they would be able to make a much more creditable showing as athletes when they became adult women. In the early history of mankind the men and women lead lives more nearly alike, and were consequently more alike physically and mentally than they have become subsequently in the history of highly civilized people.

From a physiologic standpoint, woman needs exercise just as much as man does, but, in taking up athletics, these must be regulated on a different basis. Women, as a class, cannot stand prolonged physical or mental strain as well as men do, but give them frequent intervals of rest and relaxation, and they will often accomplish as much in the twenty-four hours as men do.

From her physical configuration and her inability to bear prolonged physical and mental strain, there are certain athletic sports and games that would be likely

to prove injurious to most women if played in the form in which they are played by men. In this group are foot-ball, ice hockey, polo, basket-ball, boxing, fencing, pole vaulting, and heavy gymnastics. If these sports and games should be so modified as to meet the peculiar characteristics of women, there are none of them that could not be played with reasonable hopes of physical, mental, and moral improvement.

The athletic exercises and games to which women are best adapted, and in which they are most likely to excel, are all forms of dancing, calisthenics and light gymnastics, archery, lawn-tennis, swimming, field hockey, lacrosse, sprint running, bicycling, rowing, canoeing, golf, skating, fencing, basket-ball, and all gymnastic plays and games.

In all athletic exercises in which women engage, good form, rather than great records, should be striven for. Women may be excused for not being as strong and enduring as men, but they cannot be excused for not being more finished and graceful. Good carriage, perfect poise, self-command, and exquisite grace and refinement should enter into women's athletic performances, and these qualities should be taken into consideration by the judges in making their awards.

CHAPTER X

SYMMETRIC DEVELOPMENT: GOOD CARRIAGE AND GRACE OF MOTION THROUGH GYMNASTICS AND ATHLETICS

Gymnasiums, Baths, and Athletic Association: a Fundamental Part of a Woman's College and a Model Woman's Club; the Vassar College Gymnasium; the Standardized Percentage Table for Physical Efficiency; Special Medical Blank for Women; Self-made Good Physique through Physical Training; Rules for Taking Exercise; Gymnastic Dress; the Configuration of the Foot; Correct Attitude in Standing.

Corrective Exercises: Exercises for Developing the Various Regions of the Body; Shoulder-blade Exercises; Respiratory Exercises; Exercise for Forward Projection of Chest and Retraction of Abdomen; Shoulder and Back Exercises; Leg Exercises; Squatting Exercises for Muscles of Spine and Abdomen; Alternate Kneeling; Abdominal Exercises; Balancing Exercises for Poise and Carriage; Balancing Exercises for Extending Depth of Chest; Lateral Trunk and Waist Exercises; Exercises for Muscles of Back; Exercises for Muscles of Abdomen; Swimming Exercises, for Back, Thighs, and Abdomen; Rope Pulling-exercises for Back, Chest, Waist, Legs, and Arms; Exercises in Trunk Flexions for Back, Abdomen, and Legs; Exercises with Chest Weights for Chest, Shoulders, and Arms; Boxing and Fencing; Classic and Esthetic Dancing an Essential Feature in Physical Training; Figures of the Dance with Some Simple Exercises.

Outdoor Exercises: Effect of Walking on the Heart and Lungs; Running; Mountain Climbing; Swimming; Horseback Riding as an Exercise; Rowing.

Athletic Sports: Croquet; Lawn-tennis; Golf; Hockey; Basketball.

Gymnasiums, Baths, and Athletic Associations a Fundamental Part of a Woman's College and a Model Woman's Club.—It has been repeatedly and conclusively proved, in a large series of cases, that the physique, carriage, and health of woman can be wonderfully improved by regular and systematic gymnastic exercises, combined with outdoor exercise and athletic sports.

Briefly stated, the facts in the matter are these: the bony and the muscular systems and the vital organs are the same in both men and women, and hence the general scheme of physical training, which has been found to be so highly beneficial to men, would, if properly modified, be equally beneficial to women, and such a training for women is urged by the most competent authorities of the day.

Two-thirds of the body weight consists of bones and muscles, and the development, growth, nutrition, and vigor of the muscular and bony system can only be maintained by such exercises as will call into play the action of all of the muscles of the body, that is, the stature, breadth of shoulders, and size of the chest, as well as firm, hard muscles, are dependent on regular and systematic exercises of every part of the body, and through the beneficial effects produced through exercise on the respiration, circulation, and digestion, etc., the brain, nerves, heart, lungs, in short, all the organs and tissues of the body, are kept in a healthy condition.

The life of the masses of women to-day is being spent under artificial and the most unhealthy conditions; for the most part in overheated, ill-ventilated houses, with very little time spent in the open air, and without any knowledge or practice in games and outdoor sports.

The occupation, or lack of occupation, of the majority of women scarcely calls into play the muscles of the upper part of the body. This lack of use of the muscles about the shoulders and upper part of the chest is fatal to the development of the chest and lungs.

Outside of housewives and domestics, the majority of professional, business, and working women live under a very high nervous tension, with but a very slight range of physical activity. What they all need is a sufficient variety of exercises to call into play all the muscles and the various regions of the body, together with plenty of fresh air, amusements, and recreations. And already some of our large, wide-awake, manufacturing establishments, convinced that the practical application of these truths in

their own factories would both improve the health of their employees and be to the financial interest of the firm, are now providing well-equipped gymnasiums, under the direction of competent instructors, furnished with baths, resting-rooms, restaurants, etc., for their employees, and these experiments have demonstrated that the improved quantity and quality of the work, the lessened amount of sickness among the employees, more than compensate the employers for the expenditure of money and the time consumed in physical recreation.

It is only within the past decade that the great benefits to be derived from a systematic, gymnastic training, combined with athletic sports for girls and women, has been generally recognized. To-day all our best colleges for girls and young women have well-equipped gymnasiums, with a corps of competent instructors, where a scientific and systematic course in physical training is given during the winter months, supplemented during the fall and spring months by outdoor athletics and games. And, further, this course is obligatory during the freshman, sophomore, and junior years.

The result of the gymnastic and athletic work done at Vassar College for the past fifteen years shows a very great improvement in the physical development, the lung capacity, and the general health of the students. The average lung capacity for women is given as one hundred and fifty cubic inches; at Vassar the average lung capacity is one hundred and sixty-five cubic inches.

The Vassar College Gymnasium.—As Vassar College has a model gymnasium, an unusually fine corps of instructors, and gives the greatest attention to all the details of the physical training of its students, it may very properly serve as a model for schools and women's clubs throughout the country.

The instructors all received their training at the Sargent Normal School, Cambridge, under the direction of Dr. Dudley A. Sargent. Hence, it is naturally run along the same lines.

Gymnasium work is carried on from the middle of November until the end of March. The gymnasium is furnished with the usual apparatus for light and heavy work. The entire student body is divided into four classes; each class meets three times a week, and the period of work in the gymnasium lasts forty-five minutes. This is followed by the shower and needle baths.

The wands and dumb-bells used are wooden ones, and vary in weight from three-fourths of a pound to two and a half pounds. Other apparatus that might be used in the home gymnasium are the chest-weights and the rowing machine with a movable seat.

Instruction in classic dancing is part of the regular gymnastic work.

The Vassar gymnasium is also furnished with a fine swimming pool. The temperature of the water is kept at from 75° to 80° F. For beginners it is necessary to have a much higher temperature than for expert swimmers. Women will be greatly encouraged to learn to swim from the fact of the incredibly short time in which the art is taught here. Students learn to swim well in ten lessons of fifteen minutes each, and the great popularity of these lessons renders it necessary to limit the instruction to ten lessons. Later in the season, if there is space in the pool, the lessons may be resumed.

Before entering the gymnasium the girl is first of all carefully examined by the resident physician and gymnasium director, and the results of these examinations recorded.

A detailed series of measurements and strength tests is made and recorded on the gymnasium register. On completing the tests, the following card is filled out and given to each girl. It has been found that these cards, kept by the girls, increase the interest of each in her development, and stimulate her to further exertion to improve her physique.

PLATE VIII

Vassar College gymnasium.

VASSAR COLLEGE GYMNASIUM.—RECORD OF PHYSICAL MEASUREMENTS

MISS . . . .

EXAMINATIONS

	First.	Second.	Third.	Fourth.	Fifth.	
Height						Centimeters.
Weight						Pounds.
Lung capacity . . .						Cubic inches.
Girth, chest						Centimeters.
Girth, chest, full . .						"
Girth, chest, ninth rib.						"
Girth, chest, ninth rib, full						"
Strength, back . . .						Kilos.
Strength, legs						"
Strength, chest . . .						"
Strength, right forearm						"
Strength, left forearm.						"

The instruments needed for making these tests are the spirometer and two dynamometers, one to test the strength of the muscles of the back and legs and the other to test the muscles of the arms.

Outdoor sports and athletics are begun in the fall, on the opening of the college, and are continued as long as the weather permits. The students then take up the regular gymnastic work until the spring of the year, when athletics are again resumed. Here again three hours a week are obligatory. It should be stated here that during the menstrual period the girls are not only excused from gymnastics and athletics, but absolutely forbidden to take part in these exercises.

The list of games include croquet, lawn-tennis, hockey, and basket-ball. Rowing has always been a favorite

out-door sport at Vassar. In 1909 horseback riding was again taken up; riding lessons were begun in April, and two hundred girls took lessons. With the exception of about twenty, they all rode astride. An ordinary man's saddle can be used, but a somewhat narrower saddle, with a higher front, is more comfortable.

The Standardized Percentage Table for Physical Efficiency.—The great importance of heredity on the life history of the individual is now so generally recognized that its record becomes almost as important as that of the woman herself.

The attention of medical examiners is called to the fact that more stress must be laid upon the habits of dress in women as a frequently predisposing cause of impaired physical weakness and tendency to disease. This is emphatically so in the case of high French heels and insufficient clothing. About 75 per cent. of the women of today wear excessively high heels, and quite that number take practically no exercise.

Because of the great variation in the height of the heel of the shoe, from 1 to 3 inches, it is essential that the height should be taken in the stocking feet; and since the weight of the clothing varies at the different seasons of the year, the weight should be taken with a minimum amount of clothing on. While the chest measurements should be taken with a steel tape with all of the clothing of the chest removed; care being taken that the tape does not slip down in the back.

Difference of pulse in the horizontal and vertical positions should not exceed 15 beats; and in strong hearts the rate is just the same.

For the proper completion of this examination it is most essential that all of the endurance tests should be made.

Hopping Test.—Heart is counted with the stethoscope at apex during four consecutive 15-second periods immediately after hopping. Note per cent. of increase from

normal during first 15-second period; second, per cent. of recovery from first 15-second period to fourth 15-second period.

The *ratings* are as follows: I. For good heredity, personal history, and good present condition, 10 per cent.; II. Normal condition of heart and circulatory system, 10 per cent.; III. Normal conditions of lungs and chest development, 10 per cent.; IV. Good condition of digestive system, 10 per cent.; V. Normal condition of kidneys, 10 per cent.; VI. Normal condition of nervous system, 10 per cent.; VII. Normal condition of generative organs, 10 per cent.; Normal condition of muscular system, 10 per cent.; Tests of endurance, normal, 5 per cent.; Normal ocular and aural tests, 5 per cent.; Normal working efficiency, 10 per cent. Making for the normal total of physical efficiency 100 per cent.

No applicant should be passed who falls below 7.5 per cent. in any one group of tests, or who falls below 75 per cent. on the entire examination.

This medical blank was made to gauge as accurately as possible the physical condition of women, on which their working efficiency depends. While we cannot measure the strength and adaptability of the heart and blood-vessels with the same degree of accuracy as height, weight, and cheast measurements, yet with the physical examination and the tests of endurance we can make a very fair estimate. And we are entirely dependent for the history of heredity, personal history, and that of the digestive and nervous systems upon the woman herself; but the history of the present condition at least can be to a great extent verified or annulled by the physical examination and by the present condition.

By the quickness and conciseness with which the questions are answered; the woman's posture when she does not realize that it is being studied; her movements as she goes from one test to another and the way she conducts herself throughout this very rigid physical examination, which

working under high pressure with the aid of a stenographer and office nurse, takes one hour to complete; one can judge pretty accurately of her working efficiency.

The applicants should be graded into four classes:

Class A. Those having an excellent record in all tests.

Class B. Those having a good average record and no poor record in any test.

Class C. Those having a fair average record and who are free from organic defects.

Class D. Those having some definite organic disease which, in the judgment of the examiner, would make it dangerous for the individual to undertake any confining or laborious occupation.

Only those who come under Class "A" or "B" should be recommended for any confining or laborious occupation. By suitable methods for the correction of faulty habits of hygiene and systematic physical training for one year those in Class "C" should be able to gain admittance to one of the first two classes.

To be most beneficial to the candidate, after the physical examination is completed, there should follow a brief personal talk, making suggestions for the correction of faulty personal hygiene; and where medical treatment is indicated, instructions to place herself under the care of a physician. This has from the first been the policy of the board and of the medical examiner.

And on their part, the candidates are now beginning to thoroughly realize that these examinations are decidedly to their advantage and regard them as a privilege to which they are entitled. And the majority of them go out with the determination to get and keep well and strong.

SPECIAL MEDICAL BLANK FOR WOMEN

Report of Medical Examiner

In the case of
Address,
Place of birth,
Age, Occupation,

I. Heredity: Adverse Family History.

Tuberculosis?
Insanity or tendency to nervous exhaustion?
Cancer?
Heart disease?
Kidney disease?

Personal History.

Acute diseases since childhood?
Number of days lost in past year through illness?
Notable increase or decrease of weight during the past year?

Present Condition.

Nutrition, color, and condition of skin?
General appearance, as indicative of health?
Dress: Habits of: 1 inch heels?

II. Heart and Circulatory System.

Temperature?
Size of heart? Force of apex-beat?
Murmurs?
Blood-pressure: Maximal? Minimal?
Pulse at rest? Horizontal? Vertical? After strength tests?
Pulse, Character: Normal? Intermittent?
Irregular? Unequal?
Blood examination.—
Absence of varicose veins and hemorrhoids?

III. Lungs and Chest Development.

Respiration: Frequency? Normal? Shallow? Deep?
Auscultation? Adventitious sounds?
Girth of chest: Repose? Forced insp'n? Forced exp'n?
Ninth rib: Repose? Forced insp'n? Forced exp'n?
Normal, in relation to height?
Depth of chest: Repose? Forced insp'n? Forced exp'n?
Lung capacity, measured by spirometer?
Girth of waist?
Nose: Normal? Obstructed?
Throat: Normal? Catarrh? Tonsils: R.? L.?

IV. Digestive System.

Teeth: Good? Fair? Poor?
Tongue: Clean? Coated? Pale?
Breath?
Functional derangement of stomach?
" " " intestines?
" " " liver?
Normal size of liver and absence of tenderness?
Normal size and position of stomach and intestines?
Regularity of stools with normal color and consistence?
Constipation? Diarrhea?
Appendicitis?

V. The Kidneys.

Quantity of urine for twenty-four hours?
Frequency of urination?
Specific gravity and reaction?
Indican?
Albumin?
Sugar?
Casts?
Position of kidneys?

VI. The Nervous System.

Tendency to headache?
Character of "
Pain or tenderness of spinal cord?
Number of hours that can now be spent in study daily?
Tendency to nervous exhaustion?
Character of sleep: Insomnia?
Mental poise?

VII. Generative Organs.

Position and size of uterus?
Inflammation of uterus?
Position and size of ovaries?
Inflammation of ovaries?
Menstrual flow: Quantity? Frequency?
Pain: Before? During flow? Length of time?
Vaginal discharge?

VIII. The Muscular System.

Height? Weight? Normal?
Stretch of arms? Breadth of shoulders? Breadth of hips?
Posture: Sitting? Standing? Walking?
Figure?
Shoulders: Round? Sloping? Scapula prominent?
Spine? Lateral curvature?
Abdomen: Normal? Protuberant?
Feet: Weak ankle: R.? L.? Weak arch: R.? L.?
Flat: R.? L.?
Strength of right forearm? Of left forearm?
Strength of back? Strength of legs?
Strength of upper arms (push up)?
Strength of upper arms (pull up)?

IX. Tests of Endurance.

How long a time is spent daily in physical exercise?
What form?
What is the average rate of speed in walking?
Does hill climbing cause shortness of breath?
What out-door sports are practised?
Length of time required for test walk of three miles?
Pulse before? After?
Heart reaction to exercise: Hopping 100 feet?

Ocular Tests.

Distant vision: Right? Left?
Astigmatism?

Aural Tests.

X. General Impression of Working Efficiency.

Temperament?
Personality?
Self-control?
Initiative?
Capability?

Suggestions for Faulty Personal Hygiene.

Indications for Medical Treatment.

Remarks.

Signature of Medical Examiner, **, M. D.**

Address,

Date,

Self-made Good Physique Through Physical Training.—It has not infrequently happened that, by outdoor life and physical training, young men and women of frail constitutions have developed into strong, robust, and even physically powerful men and women.

While membership in a well-appointed gymnasium and athletic association offers the most favorable conditions for the symmetric and fullest development of the body, and when possible it is advised always to take at least a short course in physical training under the direction of a competent instructor, yet every woman has it in her power to very greatly improve her physical condition without these aids.

Systematic physical training should be begun in childhood and continued all through life.

Before twelve years of age physical training should be the same for both sexes, and girls and boys should have their sports and games together. The beneficial influence of this will be manifest for both—girls will grow stronger, less timid, and more resourceful, and boys will grow more refined and thoughtful.

But even the case of the adult woman, where not only

physical training but most of the laws of health have been neglected, is far from hopeless. A poorly developed chest, round shoulders, a beginning spinal curvature, a poor carriage, bad skin, poor circulation, indigestion, constipation, and low vitality, with poor powers of resistance to changes in the weather and environment, are not insurmountable obstacles. But a woman in this condition cannot manage her own case. She must consult and place herself under the care of a competent physician.

Two charts should be made out; the first should be a detailed outline of her present condition; to the Vassar chart already given should be added the physical defects needing correction, as round shoulders, poor chest development, palpitation of the heart on exertion, length of walk that can be taken comfortably, also the time required per mile. As the strength of the heart and lungs increases, as shown not only by the actual tests, but also by the increased powers of endurance, this first chart will be a matter of great encouragement to the woman and a great incentive to further effort. In a parallel column to the defects should be written the corrective measure for those defects. The second chart should contain the ideal measurements and strength tests for a woman of her height and weight.

Rules for Taking Exercise.—The first things to be aimed at are the proper ventilation of the lungs, together with their development, and the strengthening of the heart. During the exercise the windows must be thrown wide open, or the very object of the exercise is defeated.

Always begin with the simplest exercises and stop at the first sign of fatigue. The very first exercise will, therefore, be the simple respiratory exercises, taken in bed until one acquires some control of the muscles; they are then taken standing before a mirror, to insure the exercises being taken correctly, and after this they should be taken before an open window. The respiratory should be alternated with the abdominal exercises, and all of these should be taken for twenty minutes at a time, at least twice a day, on rising and immediately before retiring.

Two hours should be spent out-of-doors every day.

If the woman is weak and unused to taking exercise, she should walk until she feels the first signs of fatigue, rest, and then continue her walk. If the weather is too cold for sitting out-of-doors the woman should preferably take two short walks each day, one in the morning and the other in the afternoon. For invalids about ten in the morning and two in the afternoon are the best hours in winter, because of the greater warmth of the sun at those times. To be effective, exercise out-of-doors must be taken every day without regard to the weather, since the system, when in a state of activity, is less susceptible to sudden changes of temperature than when at rest.

Exercise should not be taken after long fasting; hence, never before breakfast, nor immediately after a hearty meal. An hour after breakfast or a light lunch, or two hours after dinner, is the best time for regular exercise.

A certain amount of daily exercise is essential for the preservation of the health. A healthy woman should be able to walk five miles a day, at the rate of three miles an hour, without feeling any sense of fatigue.

In order to secure the greatest amount of benefit from exercise, the mind should be entirely free from care during the exercise, so that the woman should leave her cares at home and give up her mind and body to recreation while she is out-of-doors.

Regularity in taking exercise is absolutely essential to secure good physical development and to maintain the body in a condition of health. A fixed hour should be set aside for this purpose every day.

No definite rules can be given for the exact amount of exercise to be taken at one time, but the occurrence of fatigue is the signal for rest; after a five minutes' rest, exercise may be again resumed, to be stopped again at the same signal of fatigue. Perhaps three periods of exercise, alternating with rest, may be taken, but, in order to do good and not harm, the individual must always stop before she is tired.

A period of free exercises should begin with a twenty minutes' practice, including movements for arms, legs,

back, chest, and abdomen, with especial emphasis on the correct poise and carriage of the body and deep breathing, and it should terminate with running; or, if in a class, with a running game.

For those of mature age and sedentary habits especial care must be taken not to overtax the heart, always beginning with the simplest movements and stopping at the first signs of fatigue.

In the gymnasium the periods of exercise generally cover forty-five minutes, with frequent intervals of rest in between. Even here an invariable rule should be never to exercise to extreme weariness.

All exercise should be followed by a shower or needle bath, and a vigorous rubbing with or without alcohol. Very delicate women who have been unaccustomed to taking exercise should rest on the couch or bed for one hour before proceeding to dress. It is well to sleep, if possible, and in this way they will find the good effects of the exercise very greatly increased.

Gymnastic Dress.—The usual and best style of gymnastic dress is a bloomer costume, the bloomers coming above the knees, long stockings, and thin, flat-soled shoes without any heels. The dress must be loose at the neck and waist, or it may be cut low in the neck. The sleeves are preferably short elbow sleeves.

If the exercises are taken at home, the woman may wear a combination undersuit, with stockings and broad-soled heelless slippers. The lighter the dress, the better, so that there shall be no sense of weight or restriction about the neck, waist, or shoulders.

By putting on her bedroom slippers any one can easily convince herself of the greater grip the foot has on the floor when so clad, and of the greater ease and sureness of the foot in walking.

For outdoor athletics a short skirt, coming just below the knees, may be worn over the bloomer costume. Tennis shoes should always be worn.

All rooms used for exercise, gymnasiums, and ball-

rooms must be thoroughly ventilated before the assemblage of the people. The air must be kept cool, between 50° and 60° F., and proper arrangements must be made to keep the room well ventilated while in use without causing direct drafts.

Well-waxed, hard-wood floors are the best, because they can be kept freest from dust. Students should never be allowed to enter the gymnasium with their street shoes on, as they carry with them much dust that will be thrown in motion and inhaled during the performance of the vari-

Fig. 26.—Upper surface, bones of foot (Allen).

ous exercises, and there follows not only the irritation caused by the inhalation of the particles of dust, but also the danger of inspiring all kinds of germs of disease with which the air is laden.

The Configuration of the Foot.—No study of the correct attitude of the body at rest or in motion would be complete without some knowledge of the structural arrangement of the foot. The feet form the base of support for the entire body, and at every step are subjected to a pressure of from one hundred to two hundred pounds.

This base is in the form of two arches, a transverse and an anteroposterior. The latter is the most important, and has been subdivided into two by an imaginary line, drawn between the third and fourth metatarsal bones. The inner portion of this arch is much more curved than the outer, and forms the instep. The arch is supported by two piers. The posterior pier is formed by the os calcis, or heel bone, and the posterior part of the astragulus. It is shorter, has but one joint, is more curved, and is, at the same time, more solid than the anterior pier, and receives the greater part of the weight of the body. The anterior pier includes all the bones in front of the astragulus to the junction of the three metatarsal bones with the toes. It is much the longer, is less curved, and has many joints, giving it greater elasticity, and also enabling it to diminish the force of shocks transmitted to the arch. The summit of the arch is the ankle.

It is evident that the superincumbent pressure, by flattening the arches, both lengthens and broadens the foot. The anteroposterior arch is further lengthened by a turning upward of the toes, which form a hinge-joint with the instep.

In extension the foot normally rests upon the heel, the tips of the metatarsal bones, and the outer side of the sole. In walking, running, or dancing the direction of the weight upon the arches is constantly changing, and it is only through the action of certain muscles that the normal arches are conserved. This healthy condition of the plantar arch can only be maintained by the evenly balanced action of those muscles which surround and strengthen the weak parts of the arch.

Dr. Busey's description of the foot in walking, and the injurious effects of the high-heeled shoe, is as follows: "In walking the heel touches the ground first, and supports the whole weight of the body for a moment. A little later the point of the foot touches, and assists in preserving the equilibrium by increasing the base. During the second movement of walking the heel is raised (see Fig.

27, 2), and the weight of the body is shifted more and more to the center of the foot and toes, the latter spreading and pushing the body forward. This last is the movement which displays to the greatest advantage the suppleness and elasticity of the articulations of the foot, and the adaptation of the arch to receive the weight of the body, and to transfer it to the distal pier, while the body is being moved forward by the same act. It is the execution of this movement which gives to the gait of woman that elegance and those graceful undulations which are so attractive.

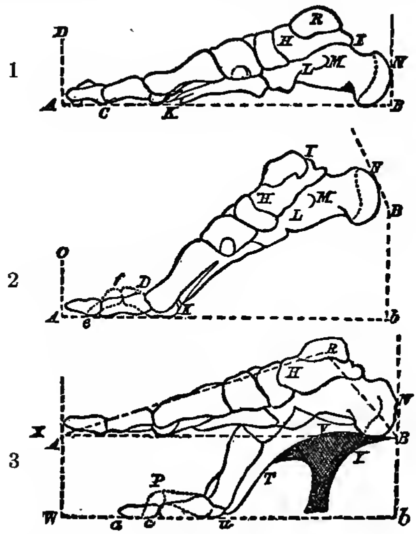


Fig. 27.—The natural and artificial positions of the foot (Camper).

"The narrow high-heeled shoe, on the other hand, by displacing the supporting base, causes both piers of the double-spanned arch to strike at the ground simultaneously. In consequence of which the gait, instead of being undulating, is stiff and hobbling, and the body advances by jerks.

"When standing on the heel bone (*NLM*, Fig. 27, 1), the joint at *K*, and the great toe *C*, touch the support upon the line *A–B*. When the feet are shod according to the present fashion, the line *A–B* is made to assume the concave form shown in Fig. 27, 3, by *BTu*. The instep is made more convex and rounded, and the foot is actually shortened (see *a–b*, Fig. 27, 3). The constant elevation of the heel places the body of the pedestrian in the same position as when standing upon an inclined plane. Again, the heel is so shaped and located that it forces up the keystone of the arch and weakens the whole structure."

The Correct Attitude in Standing (See Fig. 28).—The heels are placed nearly together, the toes pointed very slightly outward, the legs are rigid, the trunk and head are held erect, and the shoulders somewhat back, so that the chest shall expand freely. The arms should hang easily at the sides; the fingers are slightly bent, with the thumbs in front. This position of "attention" can only be maintained comfortably for a very short length of time, since the actively contracting muscles soon tire.

If the standing position has to be maintained for any great length of time, one foot should be placed slightly in advance of the other, the weight being borne upon the straight leg and the active supporting foot, the other being relatively passive. This asymmetric position has the important advantage that the two extremities may be brought alternately into play.

The most common defect in standing is that the entire weight is usually borne upon the same leg, generally the right one, while the left, being inactive, is placed out to one side; the habitual maintenance of this position leads, as we shall see later, to a tilting of the pelvis to one side, with a consequent spinal curvature and lowering of one shoulder.

Persons with strong feet, especially primitive unshod feet, mountaineers, runners, and young children, walk

with the inner borders of the feet nearly parallel to each other and the direction of motion. The best sculpture, both ancient and modern, shows the straight supporting foot, which in standing is not necessarily parallel with its mate, since the resting foot may assume almost any angle of divergence.

The influence of the stability of a correct base is well illustrated by standing on one foot and swinging the other leg backward and forward, which is much more difficult if the supporting foot be turned to one side. A runner finds it very difficult to run with the toes turned out, although the heels never touch the ground.

Corrective Exercises.—Many of the most common defects, such as a drooping head, round shoulders, flat chest, beginning spinal curvature, etc., result from a weak and relaxed condition of the muscles, whose function it is to move and support these parts. If the head is constantly bent forward in studying and writing at the desk, the muscles at the back of the neck gradually lose their tone, and stretch out like a piece of elastic that is constantly kept on the strain.

The exercises selected must be such as will strengthen these particular groups of muscles, and, while taking the exercises, the entire attention must be concentrated on the part being exercised.

Any lack of symmetry in the chest, spinal curvature, or actual weakness of the lungs will necessitate the prescribing of special and carefully selected exercises.

As to the exercises themselves, they should be so arranged as to bring into play in a methodic manner all the muscles. All special and corrective work must be supplemented by general work, which will increase the organic vigor of the heart, lungs, and chest necessary to meet the vital demands of the whole system. Games are, of course, most useful for this purpose, but the games should not be too violent.

In most free exercises the limbs are used for weights of resistance. In a man weighing one hundred and fifty

pounds the arms usually weigh about ten pounds each and the legs twenty pounds.

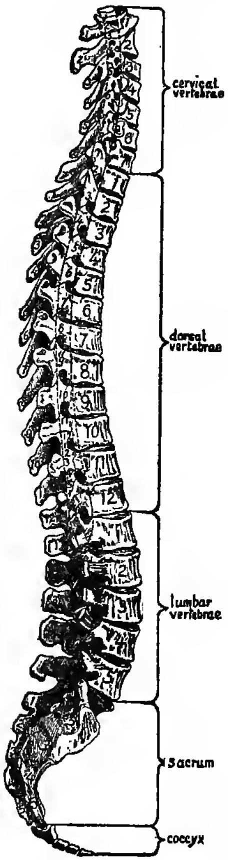


Fig. 29.—The spinal column (Church and Peterson).

The Causes of Round Shoulders.—The general conditions are those that produce muscular or constitutional weakness, as rapid growth, overwork, the impure air of ill-ventilated rooms, acute illness, near-sightedness uncorrected by glasses, lack of proper exercise, and the wearing of clothing supported by suspenders bearing on the points of the shoulders, tending to pull them downward and forward, or even to produce a painful deformity of the scapula.

It is the rule rather than the exception to find, with round shoulders, some inequality in the height. The right shoulder is apt to be the lower, owing to the carrying of burdens on the right arm. Habitual standing with the weight on the right leg contributes to a good many cases. Games in which the right arm is almost exclusively used is another cause.

The Causes of Spinal Curvature.—The spinal column forms the central support of the body, and, for grace and suppleness of motion, its thirty-four joints should be constantly exercised, as well as the muscles which hold it erect and support the head upon it, as well as attach the shoulders, hips, and legs more or less closely to it. In brief, all the muscles of the back need varied and regular exercise to maintain

the erect position of the body, and from early childhood especial attention should be given to develop and strengthen this region of the body.

The normal movements of the spinal column are flexion, extension, side bending, and torsion. Flexion and extension take place, for the most part, in the lumbar and cervical regions.

Gould believes that astigmatism is a prominent factor in the causation of spinal curvature; the curvature is affected by the tilting of the head to one side in reading or writing.

But a faulty postural habit is probably the most frequent cause both in standing and at the desk. When the weight is supported by the right leg, the left being used merely as a prop; there is a marked C-shaped curve produced, with a lowering of the right shoulder and prominence of the right hip. This position is assumed by school children for long periods of time, and there is a consequent overstretching of the ligaments of the spine and hip. These cases are generally accompanied by round shoulders and flat chest, protrusion of the abdomen, and rotation of the vertebræ.

A muscle can be developed only by the active contraction and relaxation of its fibers. Continuous tension quickly tires and lowers its tone, so that exercises given for increasing muscular power should be comparatively quick and frequently repeated, while those that aim at the stretching of muscles and ligaments should be slow and long maintained.

In all cases where corrective treatment is needed the first thing to be attended to is the general condition, and the best hygienic conditions must be provided, the general health inquired into and attended to. In all cases the eyes should be examined by a competent oculist.

All exercises and stretching movements should be given daily, with a period of rest after three or four movements, and they should be so alternated and combined that no

two, employing the same muscles in the same way, should follow one another, and so cause excessive fatigue.

The Muscles of the Abdomen.—These muscles are most important for breathing and therefore for health, for the retention in their normal position of the various abdominal viscera, for good digestion and regularity of the evacuation of the bowels. Sluggish digestion and constipation are among the commonest evils in life, and they are generally connected with relaxed abdominal walls and flabbiness of the abdominal muscles. Active pressure of the abdominal muscles on the viscera massages the liver and presses onward the contents of the intestines.

The protuberant abdomen may either be due to a faulty position in standing or an excess of fat in the great omentum, a membrane intended to protect the bowels. This excess of fat may be in turn due to lack of exercise or an excess of sweets and starchy foods, and the reduction of this superfluous fat by suitable exercises, properly taken, together with the attention to the diet, *not starvation,* is the only common sense and safe way for a woman to reduce her size.

The abdominal muscles are used in bending, in stooping forward, in raising up from the recumbent position, somewhat in climbing, and in many other movements. Trunk bending forward and backward; lateral flexions of the trunk; bending of the knees down to a squatting position, together with torsions, and all exercises derived from these types, bring into play and exercise the abdominal muscles.

EXERCISES FOR DEVELOPING THE VARIOUS REGIONS OF THE BODY

The following list of free exercises has been selected primarily for developing the lungs and chest and correcting deformities, such as round shoulders, stooping attitude, and beginning spinal curvature, when due *only* to muscular weakness and faulty attitude in standing, sitting, and walking.

Fig. 28.—Correct attitude in standing.

Fig. 30.—Correct attitude in walking. First position.

Fig. 31.—Correct attitude in walking. Second position.

Fig. 32.—Shoulder-blade exercise. First position.

Fig. 33.—Shoulder-blade exercise. Second position.

While each exercise calls into play many other muscles than the ones for whose development the exercise is given, the exercise is classed under the group for the region which it is especially designed to benefit.

Shoulder-blade Exercises (Fig. 32).—*First Position.*—Stand erect, with the feet nearly together, and the palms of the hands brought together above the head in the manner shown in the figure.

Second Position (Fig. 33).—Throw hands and forearms backward, keeping the arms on a line with the shoulders, the elbows bent, and turn the palms forward, as represented in the second position of the figure. Return to the first position, and repeat ten times. These exercises strengthen particularly the muscles between the shoulder-blades, whose function it is to hold the shoulders back.

The first point in taking each exercise is to learn the correct attitude before a mirror; after this has been mastered, the exercises should be taken with a considerable amount of rapidity and force, but not so forcibly that the collar-bone projects at its junction with the breast-bone. In throwing the hands and forearms back, the force of the motion should come at the elbows, not at the hands, and the shoulders should be carried as far back as possible.

Shoulder-blade Exercises, Number 2 (Fig. 34).—Stand erect, with the feet nearly together, and with the hands clasped behind the neck, as seen in the figure. Then force the head and elbows strongly back. Relax, letting the elbows come forward. Repeat ten times.

It will be readily seen that these shoulder-blade movements are exercises for the arms and chest as well. The object being to raise and broaden the chest.

Respiratory Exercises (Figs. 35, 36, 37).—*First Position.*—Stand with the feet nearly together, the chin down, the arms extended downward, with the backs of the hands touching, as shown in the figure.

Second Position.—The chin should be raised with the arms, so that in the second position the head is held erect.

Third Position.—The movements of the hands are carried upward still further and separated as shown in the figure. From this position the hands should be brought downward in the large sweep of a circle to the original position.

When these various movements have been accurately acquired, forcible respiratory movements should be added. Begin to inhale forcibly as the hands are raised, and hold the breath as long as possible while the hands are held above the head, and exhale forcibly while the arms are being brought down. These exercises bring into play the muscles of natural and forced respiration.

Exercises for Forward Projection of the Chest and Retraction of the Abdomen (Figs. 38, 39).—*First Position.*—Stand erect, with the arms behind the back, the hands resting in the small of the back, the fingers interlocked, and the palms facing backward.

Second Position.—Straighten the arms, turn the palms inward and then downward, and lastly out, all the while keeping the fingers interlocked. Roll the shoulders and arms into supination, and extend the neck, as in the attitude of the second position of the figure. Retain this position for a moment, then reverse slowly back into the first position.

When the fingers cannot be held in this position, start by holding a loop of cord in the hands, instead of interlocking the fingers.

This exercise is particularly valuable for projecting the chest forward, stretching the shortened ligaments, and drawing in the abdomen. Care should be taken to have the chin pressed backward when the arms are brought downward and turned outward.

Shoulder and Back Exercises (Figs. 40, 41).—*First Position.*—Stand erect, with the feet together, and both arms extended on a plane with the shoulders, so that in the first position the left arm is extended directly in front of the body and the right arm on the same plane directly behind the body. The arms must be held rigidly on the same plane.

Fig. 34.—Shoulder-blade exercise. Number 2.

Fig. 35.—Respiratory exercise. First position.

Fig. 36.—Respiratory exercise. Second position.

Fig. 37.—Respiratory exercise. Third position.

Fig. 38.—Exercise for forward projection of chest and retraction of abdomen. First position.

Fig. 39.—Exercise for forward projection of chest and retraction of abdomen. Second position.

Fig. 40.—Shoulder and back exercises. First position.

Fig. 41.—Shoulder and back exercises. Second position.

Fig. 42.—Leg exercises. First position.

Fig. 43.—Leg exercises. Second position.

Fig. 44.—Squatting exercises for muscles of spine and abdomen.

Second Position.—By a circular movement, the position of the left arm is assumed by the right, and vice versâ. During the entire movement the feet must be kept firmly planted on the floor, pivoting at the hips only, while making the continuous circular movement of the arms.

These movements consist in a torsion of the body around the axis of the spinal column, and to these can be added deep inspirations from left to right, with expirations from right to left. In addition to the effect on the circulation, the respiratory movements keep up the nutrition and efficiency of the lungs, which in old age undergo a kind of atrophy, and also maintain the elasticity of the chest-walls, which are apt to become stiff through disuse, and so interfere with the movements of the lungs and pleura.

Leg Exercises (Figs. 42, 43).—*First Position.*—Stand erect, with the hands resting on the hips and the legs crossed at the knees, with the right foot in front, as shown in the figure.

Second Position.—Swing the right leg outward and around back to about eighteen inches back of the left foot, as is shown in the second position. Then swing the right leg outward and around, back to the first position.

Reverse the position of the feet, and perform the same movements with the left leg. The weight of the body must always be thrown on the advanced leg, and perfect poise and balance should be maintained throughout the entire movement.

Leg exercises are useful for purposes of relieving the engorged veins of the fatigued leg, because the movements of such large masses of muscles as those of the legs and thighs demand large supplies of blood, and consequent quick action on the part of the heart to supply it, and this blood, pouring swiftly back to the lungs for purification, requires frequent and deeper inspirations on their part to effect the purification; leg exercises cause greater development of the chest than do arm exercises.

Squatting Exercises for Muscles of the Spine and

Abdomen (Fig. 44).—Stand erect, with the feet near together and the hands resting on the hips, rise upon the toes, then sink the body to the floor, bending the knees sharply, until the thighs and legs are doubled upon each other and the weight of the entire body is supported by the toes. The trunk must be maintained perfectly erect throughout the movement. Then return to the original position. Repeat ten times.

These exercises strengthen the muscles of the spine and abdomen, and aid in reducing superfluous abdominal fat. They also strengthen the ankles and increase the flexibility of the knee-joints.

Alternate Kneeling; Abdominal Exercise (Fig. 45). —While these exercises also strengthen the muscles of the spine and legs, they are primarily abdominal exercises, and are given for the strengthening of the abdominal muscles and improving the circulation in the abdominal viscera.

First Position.—Kneel on the left knee, with the face directed forward, the right arm extended perpendicularly up at the side of the head, and the left hand resting on the hip. The head and entire trunk are then turned slowly to the left, the right arm all the while being held rigidly up at the side of the head, then returns slowly to the original position.

Second Position.—Kneel on the right knee, with the face looking directly forward, and the left hand extended above the head, and the right hand resting on the hip. The head and entire trunk are then turned slowly toward the right, and the position maintained for a moment, then return to the original position. Repeat five times for each leg.

These exercises strengthen the abdominal muscles, those at the side of the waist, and groins.

Balancing Exercises for Poise and Carriage (Fig. 46).—These exercises, for maintaining the equilibrium of the body while it is poised upon the smallest possible base, are among the most difficult positions to maintain, requiring a high degree of coördination of movement. They

Fig. 45.—Alternate kneeling; abdominal exercise.

Fig. 46.—Balancing exercise for poise and carriage.

Fig. 47.—Balancing exercise for extending depth of chest. First position.

Fig. 48.—Balancing exercise for extending depth of chest. Second position.

Fig. 49.—Lateral trunk and waist exercise. First position.

Fig. 50.—Lateral trunk and waist exercise. Second position.

are given to improve the poise and carriage of the body.

The position of the right foot in the figure is incorrect, since the object of the movement is to have the body balanced throughout on the toes *only*. Stand erect on the tiptoes, with the arms and hands extended at the sides and above the head, as shown in the figure; then walk in the same position, with the hands carried up perpendicularly at the sides of the head.

Further benefits in the carriage of the body may be obtained by carrying light weights upon the head while performing these exercises, as a light book.

These exercises, when properly performed, expand the chest and bring into play all the extensors of the back and elevators of the shoulders. They also round out the muscles of the throat and neck.

Balancing Exercises for Extending Depth of Chest (Figs. 47, 48).—*First Position.*—Stand erect, with the heels together and the hands resting on the hips. Straighten out the right arm, and extend it perpendicularly up at the side of the head, and at the same time carry the left leg outward and upward as far as possible, according to the pose assumed in the figure. Then lower the leg and arm, returning to the original position.

Second Position.—Stand erect, with the heels together and the hands resting on the hips, as in the first position. Then take the same movements with the left arm and right leg as were taken in the first position. The arm and leg should be raised and lowered simultaneously.

All these exercises increase the vertical diameters of the chest, and strengthen the muscles of ordinary and forced respiration.

These movements also relieve the engorged veins of fatigued legs.

Lateral Trunk and Waist Exercises (Figs. 49, 50).—*First Position.*—Stand with the feet nearly together and the arms extended above the head; the arms are relaxed at the wrists and elbows, so that a slightly curved line

is formed, as is shown in the figure. First sway to the left, bending at the waist line as far as possible, and return to the original position.

Second Position.—The attitude is the same as in the first position; sway to the left in the same manner.

These exercises strengthen the muscles on the sides of the abdomen and the lower part of the back, and are an excellent means to reduce the size of the waist in case of corpulency.

Exercises for the Muscles of the Back (Fig. 51).—These exercises may be taken lying prone on the floor, with the feet caught under any piece of furniture which is strong and low enough to act as a cross-bar, as a lounge or dressing case. No one but an athlete could take this exercise without having the feet held down.

The feet should be held firmly down, and the hands may be at the sides or clasped behind the waist; the body is then slowly raised and carried backward to the half-sitting posture, then gradually lowered to the original position. These movements should be taken slowly and not repeated more than five times in the beginning.

In case of stooping or round shoulders, the hands should be clasped at the back of the neck instead of at the waist.

Raise the head and extend the spine, pressing the elbows backward. This exercise is a severe one on the extensors of the back and the rotators of the shoulders.

Exercises for the Muscles of the Abdomen (Fig. 52).—Lie supine on the floor, with the feet firmly fixed under a cross bar, or a piece of furniture which will answer this purpose, and the hands resting on the hips, as shown in the figure; slowly raise the body to the upright position, maintain for a moment, and return to the first position.

This and the preceding exercise are both excellent for strengthening the abdominal muscles and reducing an excessive accumulation of fat in case of obesity of this region.

Fig. 51.—Exercises for muscles of back.

Fig. 52.—Exercises for muscles of abdomen.

Fig. 53.—Swimming exercises: for back, thighs, and abdomen. First position.

Fig. 54.—Swimming exercises: for back, thighs, and abdomen. Second position.

Fig. 55.—Rope-pulling exercises: for back, chest, waist, legs, and arms. First position.

Fig. 56.—Rope-pulling exercises: for back, chest, waist, legs, and arms. Second position.

Fig. 57.—Exercises in lateral trunk flexions: for shoulders, chest, hips, and legs. First position.

Swimming Exercises: for Back, Thighs, and Abdomen (Figs. 53, 54).—*First Position.*—The movements given here are those for the breast-stroke in swimming. Stand with the feet about eighteen inches apart, with the right foot advanced and the right leg straight; the weight is thrown on the left leg, and the arms bent at right angles, ready for the beginning of the stroke, as shown in the pose.

Second Position.—Shoot the arms directly forward, incline the whole body forward, straighten the left leg, and throw the weight on the right, which should be bent, as shown in the second pose. Then sweep the hands and arms outward in a horizontal plane, until the arms, trunk, and legs are brought into the original position.

Then take the same exercises, reversing the positions of the right and left legs.

In taking these exercises the arms, body, and legs must work simultaneously. Special stress must be placed on the alternate flexion and extension of the front and rear leg and the inclination of the body forward with each stroke.

While these exercises strengthen the muscles of the arms, shoulders, and chest, they are especially intended for the extensor muscles of the back and thighs and muscles of the abdomen.

Rope-pulling Exercises: for Back, Chest, Waist, Legs, and Arms (Figs. 55, 56).—*First Position.*—Stand with the feet about eighteen inches apart, the arms extended out in front of the body and well out from the sides; the right foot is advanced, and the weight rests mainly on the right leg.

Second Position.—Clinch the hands tightly, as though grasping a rope, and sway to the left side, at the same time straightening the right leg; bend the left knee, and pull the hands toward the waist, as though pulling the rope in; then extend the arms and return to the first position.

Repeat the exercise with the position of the legs reversed.

The arms must be extended well out from the sides,

bending at the waist-line, so as to increase the reach, and the swaying back and forth must be done with perfect regularity.

This is a good all-around exercise, as it brings into play and strengthens the adductors of the thighs, calves, and extensors of the legs, the broad muscles of the back, the muscles of the chest, waist, and the flexors and extensors of the arms.

Exercises in Lateral Trunk Flexions: for Shoulders, Chest, Hips, and Legs (Figs. 57, 58).—*First Position.*—Stand with the feet eighteen inches apart, with the right arm extended upward and the left downward, and the weight of the body thrown on the right leg, while the left leg is extended directly to the side.

Second Position.—Change the weight to the left leg, and bend the left knee while the right leg is extended. At the same time bring the right arm down and carry the left up and sway the body at the hips to the right side. The feet are kept flat on the floor during the entire exercise, and it will be noticed that the arm, which is extended downward, is on the same side as the extended leg.

These exercises increase the flexibility of the chest, strengthen the muscles at the sides of the waist, and cause some massage of the liver.

Exercises in Trunk Flexions: for Muscles of the Back, Abdomen, and Leg (Figs. 59, 60).—*First Position.*—Stand with the feet about six inches apart, the body bent well forward at the waist-line, while the legs are rigidly extended at the knees. Increase the bend gradually at the waist until the tips of the fingers touch the floor between the feet, as shown in the pose.

Second Position.—From the first position carry the arms directly forward, upward, and backward until they reach the position shown in the second pose, with the knees and ankles flexed; bend the trunk as far backward as possible, while the arms are extended over the head. Maintain for a moment, and return to the original position.

These movements must all be taken slowly, and in the

Fig. 58.—Exercises in lateral trunk flexions: for shoulders, chest, hips, and legs. Second position.

Fig 59.—Exercises in trunk flexions: for back, abdomen, and legs First position.

Fig. 60.—Exercises in trunk flexions: for back, abdomen, and legs. Second position

Fig. 61.—Chest weight exercises for arms and shoulders. First position.

Fig. 62.—Chest weight exercises for arms and shoulders. Second position.

Fig. 63.—Chest weight exercises for shoulders and chest expansion. First position.

Fig. 64.—Chest weight exercises for shoulders and chest expansion Second position.

Fig. 65.—Chest weight exercises for extending depth of chest. First position.

Fig. 66.—Chest weight exercises for extending depth of chest. Second position.

Fig. 67.—Chest weight exercises for chest expansion. First position

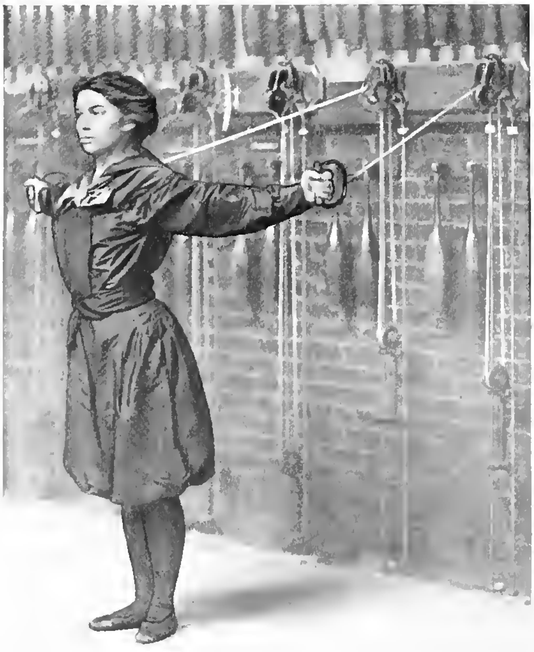


Fig. 68.—Chest weight exercises for chest expansion. Second position.

Fig. 69.—Figures of the dance. First position of the hands and feet

beginning do not attempt to go far back of the vertical line. Nearly all the muscles on the front and back of the body are involved in these exercises, but the greatest strain comes on the muscles of the back and abdomen and the muscles on the back of the thighs. The bending and rising bring into powerful action the extensors of the back and neck and the retractors of the shoulders.

After this exercise has been mastered, it can be used to still further expand the lungs, by forcible inspiration when the chest is in the most favorable position for expansion; retain the breath while the trunk is flexed, forcing the air into the cells of the lungs under pressure. This last feature of the exercise should *not* be attempted by any one with weak lungs.

Boxing and Fencing.—Boxing and fencing are both excellent exercises for the lungs, for both sides of the body, for balance, for rapidity, for endurance, variety, promptitude, and sudden adaptation; for originality, up to a certain point, as well as for self-reliance and fearlessness. They have the advantage of cheapness, and are best practised in the open air.

Exercises with Chest Weights: for Chest Expansion, Shoulders, and Arms.—These exercises are excellent for developing the muscles of the upper part of the chest, and for rounding out the chest, shoulders, and arms. They are also good flesh-reducing exercises.

The weights should be fairly light at first, beginning with perhaps two and one-half pounds, and gradually increasing until five pounds are used. The weights should only be increased with the increase of the strength of the individual. All the movements should be performed consecutively from ten to twenty times each; then proceed to the next movement.

In taking any heavy exercise great care must be used not to overfatigue the muscles, or more harm than good will be done. As soon as the muscles have become too tired to perform any exercise vigorously, it should be discontinued, and a rest of a few minutes taken, when the exer-

cise may be resumed. When a point is reached at which the muscles feel tired at the commencement of the exercise stop at once for the day.

Chest Weight Exercises for Arms and Shoulders (Figs. 61, 62).—*First Position.*—Face the chest weights, grasp the handles firmly, and hold the arms straight out in front of the chest. Stand with the heels nearly together, and far enough away from the weights to raise them a little distance from the floor.

Second Position.—Draw the two handles to the chest and almost under the arm-pits, letting the elbows and shoulders go well back; then extend the arms. Repeat ten times.

Chest Weight Exercises for Shoulders and Chest Expansion (Figs. 63, 64).—*First Position.*—Hold the arms straight out in front.

Second Position.—Then, still keeping them in a horizontal position, throw them back as far as possible.

Chest Weight Exercise for Extending Depth of Chest (Figs. 65, 66).—*First Position.*—Stand with the back to the chest weights, palms forward, arms straight.

Second Position.—Let the arms go past the sides, back and up as far as possible; then bring them down and forward and return to first position.

Chest Weight Exercise for Chest Expansion (Figs. 67, 68).—*First Position.*—Stand with the back to the chest weights, holding the arms straight out in front.

Second Position.—Then, keeping them straight and in a horizontal position, throw them back as far as possible. With the arms still extended on a straight line with the shoulders, bring them forward until the hands meet in front. This is an excellent exercise to expand and develop the chest.

Classic and Esthetic Dancing: an Essential Feature in Physical Training.—From earliest antiquity the dance has been of universal practice among all peoples of the earth, both savage and civilized, and it has been made to express all the emotions of which the mind is capable of feeling. Dancing held a prominent position among the gymnastic exercises of the Greeks.

The teachers of physical training have long felt that even the combination of gymnastics and athletic sports left much to be desired in the carriage and movements of the body, so classic and esthetic dancing, which stands between the two, more closely allied to gymnastics in its movements and to games in its spirit, was introduced as an additional gymnastic exercise, to harmonize the movements of the body, and to produce an ease of manner with a grace of beauty and of motion.

Society Dancing.—A sharp distinction must be made between the modern gymnastic dancing and society dancing. In the latter, the waltz and the two-step always require a partner. The dancing is ordinarily confined to the ball-room, with its poor ventilation and overheated air; add to these the constriction of the waist, so that the free action of the heart and lungs is interfered with, and under these conditions it may even prove a dangerous pastime to the young woman with weak heart or lungs. As a physical exercise, the waxed floor of the ball-room still further reduces its value.

Gymnasium or Classic and Esthetic Dancing.—For the gymnasium dancing there must be, first of all, the loose dress and heelless slippers, and an abundant supply of fresh air at a proper temperature, while the foot grips the floor as tenaciously as in boxing or fencing; a smooth floor renders an artistic execution impossible. The floor should be rough or covered with canvas, when dancing becomes as good a developer of the heart and lungs as running or swimming.

Girls in good physical condition can keep up esthetic dancing for an hour with very few rests or pauses. The work done in one hour is about equivalent to a walk of ten miles.

The first steps in the attainment of grace of motion is to avoid short, angular, jerky movements, and to learn to do everything, even the most difficult exercises, with the least expenditure of power and energy. This implies considerable muscular strength and great muscular en-

durance and control. As soon as the dancer loses her balance or poise, holds one arm too straight, and bends the other one at too sharp an angle, or puts too much stress on this movement and too little on that, or makes too much effort, the harmony is lost and gracefulness is not attained.

The modern gymnasium dancing conforms more completely with the requirements of good exercise than ballroom dancing, because the trunk, arms, and legs are brought more generally into action. While the exercises of the feet and calves are not so intense or so concentrated as in ballet dancing, the range and the extent of the movement are much greater. Not only are the shoulder, back, and chest muscles considerably developed by the free use of the arms, but so many of the muscles of the lower part of the back, abdomen, and thighs are used that greater respiratory power is acquired to sustain the extended action; hence, the chest-walls are expanded by the effort, and the abandonment of the corset during dancing gives the utmost freedom to all respiratory movements.

Statistics show that some of the benefits accruing from a conscientious study and practice of aesthetic dancing are, that it raises and develops the chest, lengthens the waist, and also reduces its circumference; the hips are reduced in size, the thighs and calves are enlarged, while the ankles are made smaller and the insteps are raised and given a higher arch. Properly applied and directed, dancing exercises are even a cure for flat-foot.

The improvement noted in thirteen young ladies during twenty-five days by M. B. Gilbert is as follows: The average increase in the normal chest measure, from half an inch to one and a half inches; with the chest inflated, from half an inch to one and three-fourth inches.

The foundation for this coördinate work, from which an unlimited variety of the most valuable developing exercises is formed, consists of the long-established five positions of the feet and five positions of the arms, together with positions of the whole body, known as atti-

Fig. 70.—Figures of the dance. Second position of hands; second position of right foot.

Fig. 71.—Figures of the dance. Third position of hands; third position of right foot.

Fig. 72.—Figures of the dance. Third position ("amplified") of hands; fourth position of right foot, in *front*. N. B.—When the arms are not in motion the palms must be turned down.

Fig 73.—Figures of the dance. Fourth position of hands; fourth position of right foot, in back.

Fig. 74.—Figures of the dance. Fifth position of hands; fifth position of right foot.

Fig. 75.—Figures of the dance. Forward balance.

Fig. 76.—Figures of the dance. Backward balance.

Fig. 77.—Courtesy.

Fig. 78.—Highland fling.

Fig. 79.—Hornpipe step "on heels," pulling down the small ropes.

Fig. 80.—Swedish step from "Kulldansen."

Fig. 81.—Circles with hands, from Spanish dances.

Fig. 82.—Combination of dance steps. First position.

Fig. 83.—Combination of dance steps. Second position.

Fig. 84.—Combination of dance steps. Third position.

Fig. 85.—On the toe tips.

tudes, arabesques, poses, elevations, groupings, etc. From these precepts are established, whereby steps, attitudes, and motions are systematically arranged, according to the method, and in strict harmony with time and cadence of music.

The freedom given by such dancing softens the crude awkward positions so universal among young people; the general carriage invariably improves as the head goes up and the shoulders go back; a more elastic tread and an easier propelling of the body in walking is gained. Not only is the chest broadened and deepened, and fat removed from waists and hips, and weak backs strengthened, but students gain in quickness of perception, coördination, and judgment, as well as in agility and power to keep their feet in correct rhythm.

Esthetic dancing is particularly recommended in all factories, stores, and schools where there are any large number of girls and women as a recess exercise, because in this way they get a great deal of vigorous exercise in a very short time. It brings all the large muscle groups into action, causes a rapid circulation of the blood, aërates the lungs, and it affords the best possible sort of a contrast to their monotonous and cramped positions; it is most exhilarating and it is good fun. It is an excellent mental tonic and physical invigorator; it brightens the day, and enables the women to do better work.

FIGURES OF THE DANCE WITH SOME SIMPLE EXERCISES

Fundamental Positions of the Hands and Feet (Fig. 69).—*First Position of the Hands and Feet.*—Stand erect, resting on the balls of the feet, with the chin up and the chest high; arms straight down almost touching the body; hands about 6 inches apart, slightly curved, palm toward palm; the thumb opposite the middle finger, elbows held slightly away from the body as in the figure. Stand with the heels together and the feet turned out so as to form a right angle.

Second Position of the Hands and Feet (Fig. 70).—Move the hands and arms away from each other until the hands are about 3 feet apart as in the figure. Move the right foot directly to right in line with left foot and about 12 inches away from it; toe touching floor, instep well arched, heel raised and kept turned toward left heel as in Fig. 70. Counterpart for left.

Third Position (Fig. 71).—Bring the elbows up until they and the hands are in line with the shoulders, finger-tips almost touching across chest, palms toward the body as in the figure. Move the right foot forward until the right heel is in the hollow of the left foot and at right angle to it as shown in the figure. Then move the right foot back of the left until the hollow of the right foot is back of the left heel. Notice that the feet should touch closely and the legs be very straight. Counterpart for left foot.

Third Position of Hands Amplified (Fig. 72).—Extend the hands to the sides in a straight line with the shoulders; if this position is to be maintained turn the palms toward the floor, with the thumb under the middle finger.

Fourth Position of the Right Foot in Front (Fig. 72).—Move the right foot directly forward about 12 inches in front of the left foot, as in the figure, toe touching the floor, heel raised; instep arched. Counterpart for left foot.

Fourth Position of Hands (Fig. 73).—Move hands and arms up until the hands are about 3 feet apart above the head; palms toward each other, arms nearly straight as in the figure.

Fourth Position of Right Foot in Back (Fig. 73).—Move right foot about 12 inches back until in line with left foot, toe touching floor, heel raised as in the figure. Counterpart for left foot.

Fifth Position of Hands and Feet (Fig. 74).—Move hands more closely together until about 6 inches apart; palms toward each other and the arms very slightly bent as in the figure.

The right toe touches the left heel in back, or right heel

touches left toe in front as in the figure. The feet are at right angles. Counterpart for left foot.

Elevated Position of the Feet.—The second and fourth positions may be elevated by extending the leg and foot at right angles to the body. See Figs. 70, 72, 78, 82, 83, and 84. The third and fifth positions become elevated by raising the foot, toe pointed to the floor, as in combination of steps, Figs. 78 and 82.

N. B.—In elevated positions the toe must be extended so that the foot and leg form a straight line.

Simple Exercises Using the Fundamental Positions.—Stand with feet in first position; hands in first position (Fig. 69).—*Exercise 1.*—Move right foot to second position (Fig. 70), and back to first position four times. Left foot the same.

Exercise 2.—Move right foot from fourth position in front (Fig. 72) to fifth position in front (Fig. 74). Repeat four times. Right foot in back (Fig. 73), fourth to fifth, four times. Left foot in back, fourth to fifth, four times.

Exercise 3.—Move right foot from second position to third in front, to second, to third in back. Repeat four times. Left foot the same.

To make the exercise more difficult, hold the skirt extended with the hands in the second position (see Fig. 77). Or arms extended in third position amplified, palms down, which is very difficult.

Music in 6/8 time will add interest.

Arm Movements.—*Exercise 4.*—Move hands from first position to second and back to first. Repeat four times. N. B.—Draw the hands away from each other by the wrists, and toward each other by the wrists. The hands should move as though trailed through water.

Exercise 5.—Move the hands from the third position, to the third position amplified, and back again to third (Figs. 71, 72). Repeat four times. N. B.—Move to third position from first position. Do not go directly from the first position to third position amplified, but through third position in front.

Exercise 6.—Move hands from fourth to fifth position, four times.

Exercise 7.—Move right hand to fourth position, left hand to second position, starting from third in front, back to third position. Repeat four times. Change hands, moving right to second, left to fourth position.

Use slow rhythmic waltz music for exercises 4 to 7.

Combination of Hand and Foot Movements.—Waltz music at first and later 6/8 time.

Forward Balance (Fig. 75).—Step forward on right foot, left foot extended in fourth position back; right hand in fourth position, left hand in second.

Backward Balance (Fig. 76).—Step back on the left foot, raising the right foot in elevated third position in front; right hand in third position in front of waist, left hand in fifth position. Counterpart, starting with left foot.

Courtesy (Fig. 77).—Grasp the skirt lightly at either side between the fingers, keeping the backs of the hands forward; hands in second position. Point the right toe in second position. Count, "One, Two." Lifting the heels, turn on both toes until you face toward the left. Count, "Three, Four."

Place the left foot in fourth position back of right foot, bending both knees as if you were sitting down. Count, "Five, Six." Slightly spread the skirt. N. B.—Keep the body erect from the waist up.

Rise to the standing position, drawing the right foot backward into the first position. Count, "Seven, Eight."

Counterpart for Courtesy to the left. Music, Gavotte or Schottische played slowly.

Highland Fling Step (Fig. 78).—Point right foot to second position, right arm is bent at elbow and wrist, left arm is almost in fifth position. Hop on left foot, at the same time bringing right foot in very elevated fifth position back of left knee. Hop on left foot bringing right foot in front of knee; hop on left foot bringing right foot back of knee again. Repeat to the left with hands in corresponding positions.

Hornpipe Step (Fig. 79).—Keeping feet in first position, walk forward on the heels very quickly, taking steps of about 1 inch in length. Look up and with the hands keep pulling down an imaginary rope, moving one hand constantly above the other.

Swedish Step from "Kulldansen" (Fig. 80).—Place right heel in second position, arms in second position modified. Bow to the right, bending at the waist. Repeat to the left with the left heel in the second position, right foot in first position. Repeat several times.

Spanish Circle with Hands (Fig. 81).—Kneel on the left knee. With both hands make circles going from left to right, sweeping from third position at floor level to fifth position and back again, four times.

Combination of Dance Steps—First Position (Fig. 82).—Left foot in fifth position front. Swing the left foot in circle to fifth position in back. Right hand holding skirt in third position in front, left hand holding skirt in third position amplified.

Second Position (Fig. 83).—As left foot arrives in back of right, swing arms to third position amplified. Move the left foot to second position.

Third Position (Fig. 84).—Move the left foot to the fifth position in front, kicking the right foot in second position elevated. Right hand in third position; left hand in third position amplified.

Pose on Toe Tips (Fig. 85).—Rise on the tips of the toes, the feet as close together as possible, bringing the hands from the first to the fifth position.

When the pupil has mastered these very skilfully arranged series of dancing poses, steps, and exercises *she has learned how to dance;* that is, she is in a position, after watching any new dance for a short time, to go on the floor with a leader.

Women in the prime of life will be interested to know that in twenty lessons of one-half hour each, given at the Women's University Club under the able instruction of Miss Rabinovitz,[1] to a class of women ranging in age from

[1] Superintendent of Dancing, New York Public Schools.

thirty to fifty years, two-thirds of whom had either never learned to dance or who had not danced since childhood, not only learned the above various dancing steps and exercisers, but also the following dances.

The Folk Dances were: The Tantouli (Swedish); Ace of Diamonds (Danish); Reap the Flax (Swedish); and the Sailor's Hornpipe (English). This last dance was especially for the very excellent exercise which it afforded. The Minuet was taught for form, grace of movement, and exercise. There were also taught the Hesitation Waltz, the Maxixe, and the Lulu Fado.

Outdoor Exercise.—Outdoor exercise must be regarded as one of the essentials to good health, and as such must be classed with food, clothing, bathing, and sleep.

In addition to the beneficial effects of exercise on the muscles, circulation, and all the functions of the body, are the soothing effects of outdoor life on the nerves. It is only out-of-doors, in the parks, in the country, or by the sea that one is soothed into entire oblivion and forgetfulness of the cares of life, and to such a degree that the individual may be said to be hypnotized by the powers of nature, so that the mind is almost as perfectly at rest as in a sound sleep.

The time spent out-of-doors should not be less than two hours daily. Actual experience of busy workers will prove that not only is this time not lost, but that actually more and better work can be done in the day, and that the resulting improvement in the general health will be so great that much less time will be lost through indisposition and actual sickness, so that the daily outdoor exercise will be found to be a great economic gain.

Outdoor exercises, such as walking, running, swimming, and hill and mountain climbing, possess the very great advantage that indulging in them demands no expense, and are, therefore, open to all. All these exercises develop the lungs and chest and strengthen the heart, and are, therefore, classed under exercises of endurance.

The Effect of Walking on the Heart and Lungs.—

In a slow walk the respiratory action is almost double the ordinary amount; in walking at an ordinary pace, that is, about three miles an hour, it is four times as great; while in a vigorous or hasty walk, that is, at a rate of from four to six miles an hour, it is from seven to nine times as great.

The change of speed from three to five miles an hour elevates an automatic, listless occupation into a vigorous exercise, employing many new muscle groups and stimulating the heart, lungs, and skin, while the change from a smooth, level road to the broken ground of the mountainside may be dangerous for many a one who is able to walk at a moderate speed on level ground.

In walking the clothing must be sufficiently loose not to interfere with the more rapid respirations and the increased action of the heart. When the heart cannot keep pace with the demanded speed of the circulation, a "stitch" ensues, and getting one's second wind means that the heart has succeeded in accommodating itself to the strain. Too great a "stitch," resulting in absolute breathlessness, is a warning that must not be disregarded.

This increase in the respiratory action is important, as compared with the brief and transient increase from exercise with apparatus, because a quick walk can easily be kept up for several hours.

The fatigue is small, because, in the first place, of the abundant supply of oxygen; the will is scarcely used, and walking is almost automatic, partly because the muscle areas used are large, and each movement prepares for the next. Walking is a heart and lung exercise of a very excellent sort.

The Effect of Walking on the Movements of the Blood in the Legs.—The circulation of the blood depends on the pumping of the heart, which is in turn affected by the suction action of the lungs and the muscular movements of contraction and relaxation which go on rhythmically. While in prolonged standing the veins of the legs become fuller, and the circulation of blood in them more sluggish,

and by the laws of gravitation the blood is kept down in them. Hence also in walking slowly with short steps the legs remain overfull of blood and become heavy. Instead of being quickened, the circulation is actually hindered, for the waste-products are not carried away quickly enough. Hence, slow walking soon causes a feeling of fatigue, while the vigorous walker, going along with long strides, keeps fresh.

Rules for Long Walks.—In walking, not only the distance should be taken into account, but the character of the road and the incline of the ascent. A distance that could be easily covered on a smooth, level highway may mean double the expenditure of muscle and nerve force if the ground is sandy or very damp. Other hindrances to be taken into consideration are opposing winds, not only because of the resistance, but also because of the inhalation of dust and rain.

The walk should be occasionally broken for short periods of rest. The pauses should be short, about five minutes, and during this time the body should be erect. Experience proves that sitting down makes one more tired on getting up again. A short halt should be made before climbing a steep ascent, so as to begin with fresh strength and easy breathing, as this means increased work for the heart and lungs.

In starting out for a walk, one should begin slowly, and gradually increase the pace, and in returning the same rule should be observed.

Running.—The force exerted in running is enormous. In running it is the length of the step more than anything else which increases the speed of the run; hence, the runner should learn to take long steps. But the greatest speed can only be kept up for a limited time; the distance is one hundred yards.

Running is the most effective of all exercises of speed, and, like all exercises of speed, can be changed into one of endurance by a certain moderation in the pace. By

running the heart and lungs are developed more than by any other exercise.

Age Limit for Running.—All ages are not equally well adapted for running: they do not all share in its good results. Running is best for all young people, before and at the age of puberty. Running is then quite a necessity. The growing child is always ready for a run. From the fortieth year on running, as an exercise of speed, becomes less and less desirable, and, when the organs of circulation or breathing are impaired, it must be absolutely forbidden.

In running always begin slowly—running moderately, for instance, for fifty feet; then increase the speed gradually, but when running for exercise, never speed to the utmost, as this is not necessary for the benefits of the exercise. Always close the run with the same moderation with which it was commenced; that is, never stop short, as this sudden arrest of action gives a most undesirable shock to the heart. The movements of running may easily be imitated in the house, while standing in one place, and simply lifting the feet in the same quick alternation from the floor.

Mountain Climbing.—The advantages of mountain climbing are manifold. The weight of the body has to be carried up a certain height. To accomplish this the work of the muscles is increased; the breathing must be deeper to satisfy the increased demands for oxygen; fresh air is admitted into the apices of the lungs, which do not, as a rule, participate in respiration. A more powerful action of the heart takes place, but care must be taken that this is not carried too far. Slow climbing, without any unnecessary waste of energy and with appropriate pauses, to allow the heart to recover, is advantageous. One should not talk too much while climbing. The dress should be suitable; the neck must be free and the shoulders not heavily weighted, so that they may be drawn back and the chest fully expanded.

Swimming.—Of all outdoor exercises for women, swimming is one of the most perfect. It not only calls

into vigorous action most of the muscles of the body, but spares many of those muscles which are so commonly overworked, most of the work being performed by muscles which are so little used as to have become weak and flabby.

For instance, the extensors of the fingers and the hand, that are so constantly stretched in sewing and writing, are in constant use in swimming, while the corresponding flexors, the slaves of the needle and the pen, are relaxed. Again, the muscles passing from the shoulder-blades to the trunk, on which depends much of the erect carriage and strength of the chest, which have become wasted from disuse while the woman sat at the desk or bent over her sewing, are the very muscles by which the movements of the upper half of the body are executed, while all the muscles of the lower extremity are brought into use. Of especial value is the free movement of the hip-joint, a joint that is seldom moved with any degree of freedom from the time a girl leaves climbing trees, unless she has the advantage of special gymnastic training. The vigorous action demanded of the respiratory muscles greatly increases the chest capacity.

The body is lighter than the water, and is perfectly supported by it, so the weight is taken off the spine, and the muscles of the back are relieved from their normal state of tension. The head is the only part of the body that is held up by muscular action, and, in floating, even this is supported by the water.

The disadvantages arise from the fact that the temperature of the water is very much below that of the body, so that there is a greatly increased conduction of heat from the body, and, unless this loss is made good by exercise, there is very great danger of a chill. In most persons a prolonged stay in cool or cold water produces a liability to cramp.

During the month of August the temperature of the ocean reaches its maximum of 66.65° F. This is about 32 degrees below the temperature of the body. Upon

entering the water the first effect noticed is a sensation of cold; this varies with the susceptibility of the individual, and the difference between the temperature of the water and the surrounding air. The skin assumes the appearance of "goose-flesh," the face is pale and anxious, and the lips are blue; the pulse decreases in frequency, a sense of oppression is manifest, and there may be spasmodic shivering; that is, the first effect of immersion is to cause a contraction of the blood-vessels of the surface of the body. This should be quickly followed by a secondary reaction, in which there is a sensation of warmth, a quickened pulse, and an increase of energy. When, by taking the proper precautions, this reaction does not occur, it is a contraindication to sea-bathing and swimming.

If the immersion has been too prolonged, there is a second sensation of chilliness, a signal that the bather must leave the water at once.

The best time for bathing is between eleven o'clock in the morning and four in the afternoon, depending on the tide. No one should go into the water within two hours after meals, nor should she on leaving the bath proceed at once to the table, since digestion draws the blood from the periphery to the stomach, and to eat immediately after bathing is to lose most of the benefit of the saline treatment.

All should avoid cold-water bathing when fatigued, and swimmers ought to pay especial attention to this point, on account of the demand they are going to make on their muscular system; and on no account must one enter the water when in a perspiration; a moderate walk along the shore should be taken until the perspiration has subsided. These precautions are of the highest importance, and disregard of them may prove fatal.

Enter the water quickly until it reaches the waist, then plunge headlong, or cover the body to the neck. Care should be taken to wet the chest and abdomen immediately on entering the water, since these parts are the most sensitive to the impression of cold.

Every one should learn to swim, and those who cannot must move the arms and legs about vigorously. The duration of the bath should depend on the state of the health of the individual, on the state of the weather, and on whether the water is rough or calm. The average duration of the time spent in the water should be from three to fifteen minutes, the latter being the maximum time for any one. No benefit will accrue from spending a longer time than this in the water, and much harm may result.

The sea-bath should be followed by moderate exercise, in order to insure a perfect reaction, and to aid in expending the superfluous energy which sea-water imparts.

Swimming and sea-bathing should be avoided by persons who have weak hearts and a poor circulation, in whom the reaction after a plunge into cold water is never well established. Also by persons with heart or kidney disease, and by all feeble and old persons.

Persons with feeble constitutions, but with no actual disease, as in various forms of nervous disorders, insomnia, etc., generally derive marked benefit from sea-bathing.

Persons who are weak should walk and not plunge into the water. As in all other exercises, a determination on the part of the weak to equal the strong is a fertile cause of mischief.

Horseback Riding as an Exercise.—The advantages claimed for horseback riding are that it acts on nearly every muscle of the body, while the mind is interested and refreshed. An insuperable disadvantage to the majority of women living in large towns and cities is the enormous cost of the exercise.

The value of horseback riding for women has been greatly diminished by the very faulty position caused by the side-saddle, which produced a cramped position of the body and a tendency to lateral curvature of the spine. Then, too, women ride too tightly corsetted, thereby preventing much good that would otherwise accrue to the circulation and digestive organs.

When the woman rides astride, the body is held erect

and in a natural position, and she sits much more firmly on her horse and, if not corsetted, it becomes an exhilarating and delightful form of exercise. The best results will probably be found in a neurasthenic class of women, who are not strong enough to take more active exercise, and for them it will be of decided therapeutic value to both mind and body.

Rowing.—This is one of the most beneficial of exercises; it has the advantages of scenery, freedom from dust, and companionship; it exercises equally both sides of the body and most of the muscles. It is an excellent exercise for strength, rapidity, and endurance.

In correct and graceful rowing there is a pendulum-like movement from the hips. The rower should sit with the trunk fully extended, the head up, the eyes to the front, the chest thrown forward, and the weight of the trunk equally distributed upon the two sides of her seat. The feet rest against the stretcher, the two hands should be near together, and should be held symmetrically at an equal distance from the body.

Stretching.—The body and extended arms are brought forward as far as possible. The spinal column should be kept extended, not bent so as to make a crooked back, and the trunk should be thrown forward from the hip-joints. When the stretch has reached its forward limit, the oar is dipped into the water just far enough to cover it; then immediately the pull begins, and it must be continued evenly to the end.

The Pull.—The body rises erect from the hips and swings backward. The hands should not reach the front of the chest until the body has passed the perpendicular and is sinking back. When the pull is finished, the hands are dropped and suddenly bent toward the wrists. This lifts the oar out of the water, and keeps its lower surface parallel with it; during the stretching forward, the oar is kept parallel with the water, so that it has not much resistance from the air.

The muscles brought chiefly into play are the long

muscles of the back in the backward swing, and the abdominal muscles in the forward swing. But the muscles of the pelvis, thighs, and legs all have to work, likewise the muscles of the arms, chest, and shoulders. And it is one of the best exercises for developing the lungs and chest, as well as of strengthening the heart. Fatigue will be felt most in the muscles of the legs, hips, and arms, but the exertion is so well distributed that it causes much less fatigue than would otherwise be the case.

Athletic Sports.—Athletic sports possess three distinct advantages—they are played out-of-doors, and give an incentive to taking the proper amount of exercise; they are all team games, and so develop the social and coöperative spirit; and last, but by no means least, they afford a great deal of amusement and real recreation.

Formal and systematic gymnastics are essential for the development of the body and the correction of its defects; out-of-door exercise is excellent, but the solitary walk, climb, swim, or row leaves much to be desired, while in walking especially the mind is free to pursue the same trains of thought which with it was occupied at the desk, and so it fails to be properly refreshing to the mind and body. Whereas in all athletic sports the ego has to be pushed into the background, with all its interests, the day's work left behind, and the entire attention concentrated on the play. This is a very distinct advantage to the individual.

Women at all ages take themselves and life too seriously. This is in all probability due to a defective early education; between the long school hours, home study, housework, and sewing, they had neither time nor opportunity to cultivate a love for play and games, and so the play instinct was not developed, and if not developed in youth, the chances are that it never will be. In middle and advanced age, when the stress and storm are at their height, nothing is so sure a restorative to overtaxed brains and overwrought nerves as games, sports, and a love of fun.

As a result of our unnatural mode of life in youth, it has

come to pass that American women especially have been defrauded out of their birthright of the love of games and sports. Athletic games and sports are as essential to a scheme of education as are reading, writing, and arithmetic.

Other distinct advantages accruing to athletic games are that here the individual becomes acquainted with her powers and weaknesses. In formal gymnastics the movements follow each other in a regular sequence, through lines already carefully laid out; in games, on the contrary, no two plays or combination of plays are exactly alike. One can never tell what her opponent is going to do, and yet what one's opponent does is so vital to the success or failure of the game that the player must decide quickly and accurately how that move in the game can best be met, so that intense concentration, quickness, alertness, prolonged attention, self-control, and even self-sacrifice are called for, for in the team game the individual interests must be submerged, in order that the side may win; and so the individual power, sense of responsibility, and an *esprit de corps* are developed, in a manner almost impossible in the same degree in any other way.

The principal outdoor games for women are croquet, lawn-tennis, hockey, golf, hand-ball, basket-ball, baseball, boxing, and fencing.

Croquet.—Of all these games, croquet is the mildest, and for that reason is a good beginning game for a woman who has always led a sedentary life, or for a woman who has become enfeebled through serious illness. It is also an excellent game for old age.

To be beneficial and not detrimental, the exercise must be very gradually increased, both in the length of time occupied and in the vigor of the movements. The muscles must be slowly built up and improved in tone, the lungs developed, and the heart strengthened.

Another advantage of croquet is that it is inexpensive and requires a limited amount of ground.

Lawn-tennis.—Tennis is a much more violent exercise

than croquet, and is a game for young people and youth. Now, as to just what constitutes youth: it is altogether a question of the condition of the arteries, heart, and muscular system, and is not a question of years *per se*.

The game is moderately expensive; played with four, it is not at all violent. It is an excellent game for social purposes, and can be kept up until late in life, but it cannot be begun late in life. It has just the proper amount of variety, activity, and endurance to suit hundreds of people for whom croquet would be too mild, and for whom ball-games would be too severe.

Golf.—Golf is deservedly a very popular game at all ages. Perhaps the greatest drawback for the city dweller is the inaccessibility of the golf links and the great expense of the game.

It combines scenery, walking for several miles, some hill climbing, and a considerable amount of exercise for the right side of the body, particularly for the right arm, and the muscles of the right side of the back and chest. The great drawback, from the physical standpoint, is an overdevelopment of the muscles of the right side of the body, which, in the majority of people, are already better developed than those of the left side; the muscles of the left side of the body are brought very slightly into play.

While the distinct advantages of the game are combined with walking, the healthy body swings, the accuracy needed in making the drives, the distance of the drives, the variety of implements as well as of stroke, and many other features, and, further, it is a game that keeps one pleasantly employed in a company of one's choosing for several hours.

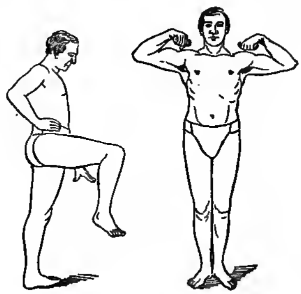
Hockey.—Hockey is among the finest of games for most young people, and should rank at least third among games. It has most of the advantages of foot-ball, and many of the advantages of cricket. It involves a considerable amount of running and a great deal of real sport and fun.

Basket-ball.—This is another of the most popular games for young people, and possesses in a very great degree all the advantages of a team game. The confidence that follows a successful throw proves of considerable value, unless it leads to the carelessness of overconfidence. Faith in the ability to get out of a desperate situation in the tossing increases with success. This leaves the attention imperturbed, and one does not go to pieces. According to Mosso, movements develop the brain, and it has been repeatedly noticed that intelligence in animals increases with the increased motility of their extremities.

INDEX

Pyle's Personal Hygiene

Sixth Edition



Dr. Pyle's book contains many things you should know to keep you in good health—that good health which is the first requisite of happiness and success in life. It tells you how to live properly on a physiologic basis. It tells you what the foremost medical authorities in America teach on subjects of such general interest as eating, drinking, breathing, bathing, sleep, and exercise. It teaches you the hygiene of the nose, throat, chest, and lungs; of the vocal and respiratory apparatus; of the ear, eye, brain, nervous system.

By American Authors. Edited by Walter L. Pyle, A. M., M. D., Wills Eye Hospital, Philadelphia. Sixth Edition. 543 pages, illustrated. *Price: $1.50, postage free.*

McKenzie on Exercise

The author is an authority in this field. He gives you here the very latest advances both in the developmental exercises and physical training of the school, gymnasium, field, and playground, and in the correction of abdominal weakness, constipation, respiratory diseases, stammering, chorea, *infantile paralysis.*, etc. The contents include physical training in Young Men's Christian Associations, Camps, Boy Scouts, and Camp-Fire Girls.

By R. Tait McKenzie, B. A., M. D., University of Pennsylvania. 585 pages, with 478 illustrations. *Price: $4.00, postage free.*

Sound Reasoning and Practical Advice are what Dr. Anna Galbraith gives you on the art of Keeping Well

Personal Hygiene for Women

RESPIRATORY EXERCISE
(Illustration much reduced)

This simple manual will help you immeasurably. It gives you just the information you want. It tells you how to train your physical powers to their fullest development. It helps you make the most out of yourself, to get out of life that perfect happiness that can only come to those of perfect health. For home-study and as a text-book it has no equal. It is a book for every woman.

By Anna M. Galbraith, M. D., Fellow of the New York Academy of Medicine. New (2d) Edition. 393 pages, illustrated.
Price: $2.25, postage free.

The Four Epochs of Woman's Life

Women have at last awakened to a sense of the penalties they have paid for their ignorance of those laws of nature which govern their physical being. Maidenhood, marriage, maternity, and menopause—these are the periods of a woman's life fraught with the greatest dangers. Well-ordered education in these subjects lessens suffering and is essential to prevention of disease. Dr. Galbraith discusses the subject in a modest and conclusive manner. *Sex Instruction* is handled most admirably.

By Anna M. Galbraith, M. D., Fellow of the New York Academy of Medicine. Third Edition. 300 pages.

Keefer's Military Hygiene

This subject is one of the many which the present crisis has forced upon public attention. Military sanitation is a very important phase of national preparedness. Dr. Keefer is in every way equipped to teach the subject, and he has, moreover, incorporated the views of the ablest investigators in the discussions. He gives you chapters on the hygiene and sanitation of every side of military life

By Lieut.-Col. Frank R. Keefer, A. M., M. D., United States Military Academy, West Point. 305 pages, illustrated.

Price: $1.50, postage free.

Kaupp on Poultry Culture

This work gives you the breeds and varieties of poultry, problems of mating, breeding, hygiene, equipment, ridding stock of vermin, internal parasites, and other diseases; the feeding problem and food-stuffs, compounding rations, fattening, broilers, dressing, packing, selling, care of eggs, incubators, brooding, marketing eggs, handling feathers, value of droppings as fertilizer, caponizing and spaying, preparing birds for showroom, and construction of poultry-house equipment.

By B. F. Kaupp, M. S., D. V. M., North Carolina Experiment Station. 418 pages, 197 illustrations. *Price: $2.00, postage free.*

Winslow's Prevention of Disease

ADENOIDS

There are 800,000 deaths every year in this country *from preventable disease.* The greatest—and, in fact, the *only*—safeguard against the spread of disease is a helpful knowledge of its causes by the layman. No amount of watchfulness can save you unless you know *how, when,* and *where* to be careful. Dr. Winslow's book begins with the care of the child shortly after birth, and follows every step of its development throughout life. Its contents cover every disease that flesh is heir to, from infancy to old age. It is a book that aims to keep you well and prolong your life.

By Kenelm Winslow, M. D., formerly at Harvard University. 348 pages, illustrated. *Price: $1.75, postage free.*

Morrow's Immediate Care of Injured

Dr. Morrow's book tells you *just what to do* in any emergency, and it is illustrated in such a practical way that the idea is caught at once. You get first a brief outline of the anatomy and physiology of the human body, essential to rendering intelligent assistance in cases of injury and sickness. There follow chapters on bandaging, dressings, practical remedies, when and how to apply them, and the best way to treat every emergency condition.

By Albert S. Morrow, M. D., New York Polyclinic. 360 pages, 242 illustrations. Second Edition. *Price: $2.50, postage free.*